

# Town of Cavendish

## Local Hazard Mitigation Plan

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***2023-2028***

DRAFT of August 4, 2023

Adopted by the Town of Cavendish

MM DD, YYYY

*Prepared by*

*Town of Cavendish*

*and*

*Mount Ascutney Regional Commission*

**CERTIFICATE OF ADOPTION**

Town of Cavendish, VT  
Selectboard

**A Resolution Adopting the  
Town of Cavendish 2023-2028 Local Hazard Mitigation Plan**

WHEREAS, the Town of Cavendish has worked with Mount Ascutney Regional Commission to prepare an updated hazard mitigation plan for the town to identify natural hazards, analyze past and potential future damages due to natural and man-made caused disasters, and identify strategies for mitigating future damages; and

WHEREAS, duly-noticed public meetings were held by the Cavendish Selectboard on MM DD, YYYY to present and receive public comment on the draft Plan; and

WHEREAS, the updated Town of Cavendish 2023-2028 Local Hazard Mitigation Plan demonstrates the community's commitment to implementing the mitigation strategies and authorizes responsible agencies to execute their actions; and

WHEREAS, the updated Town of Cavendish 2023-2028 Local Hazard Mitigation Plan was submitted to Vermont Emergency Management and the Federal Emergency Management Agency for review on MM DD, YYYY; and

NOW, THEREFORE BE IT RESOLVED that the Town of Cavendish Selectboard hereby adopts the 2023-2028 Cavendish Local Hazard Mitigation Plan for municipal use and implementation.

Duly adopted this \_\_\_ day of \_\_\_, 20\_\_.

Selectboard

\_\_\_\_\_  
Chair, Cavendish Selectboard

\_\_\_\_\_  
Member

\_\_\_\_\_  
Member

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Member

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Member

## Table of Contents

1. INTRODUCTION .....	5
2. PURPOSE .....	6
3. TOWN PROFILE .....	7
4. PLANNING PROCESS .....	11
4.1 Public Involvement .....	13
4.2 Resources Consulted .....	13
4.3 Review of Town Progress, Resources, and Capabilities .....	14
5. HAZARD IDENTIFICATION and ASSESSMENT .....	21
5.1 Hazard Impact Assessment .....	21
5.2 Hazard Profile .....	23
5.2a Wildland Fire .....	26
5.2b Inundation, Flash Flooding & Fluvial & Erosion .....	29
5.2c Heavy Snow, Ice & Extreme Cold .....	43
5.2d High Wind .....	49
5.2e Extreme Heat & Drought .....	52
6. MITIGATION PROGRAM .....	58
6.1 Public Involvement .....	58
6.2 Hazard Mitigation/Preparedness Strategies and Actions .....	58
6.2a Changes from Prior Plan .....	59
6.2b Prioritization of Strategies and Actions .....	60
6.3 Plan Monitoring and Maintenance Process .....	69
APPENDICES	
Appendix A:	
Map 1: Current Land Use	
Map 2: SFHA Structures	
Map 3: Water Resources	
Map 4: Transportation Resources	
Map 5: Elevation and Slope	
Map 6: High Hazard/Vulnerable and Critical Sites	

Map 7: TRPT Map

Appendix B: Public Involvement Documents

Appendix C: Process Flow Chart

Appendix D: Town Plan Review

Appendix E: Vermont Historic Floods

Appendix F: July 2023 Flood Damage

Appendix G: Plan Monitoring Forms

**Add Section 5.3: Summary of Vulnerable Areas and Assets**

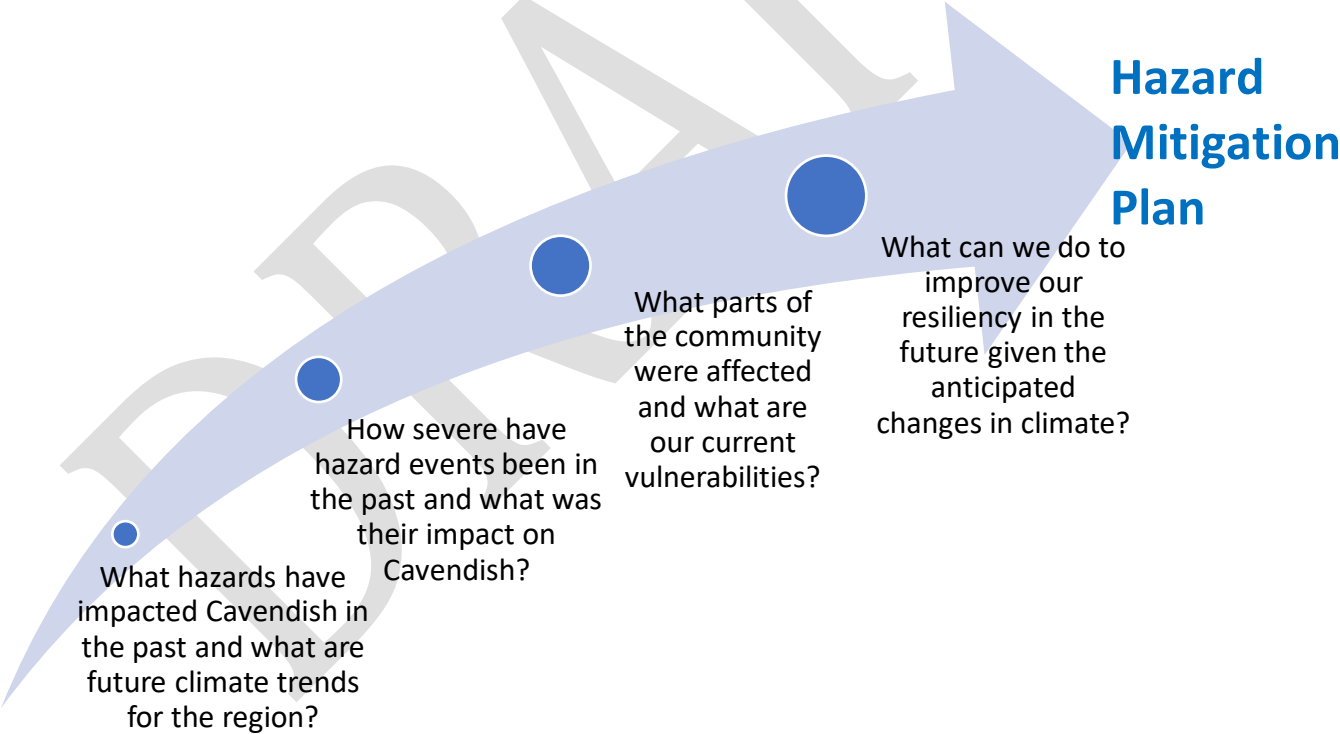
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# 1. INTRODUCTION

This Local Hazard Mitigation Plan is intended to assist the Town of Cavendish in identifying and understanding the risks of natural hazard events to the community and developing strategies and actions that can be taken to improve the resiliency of the local community to hazard events.

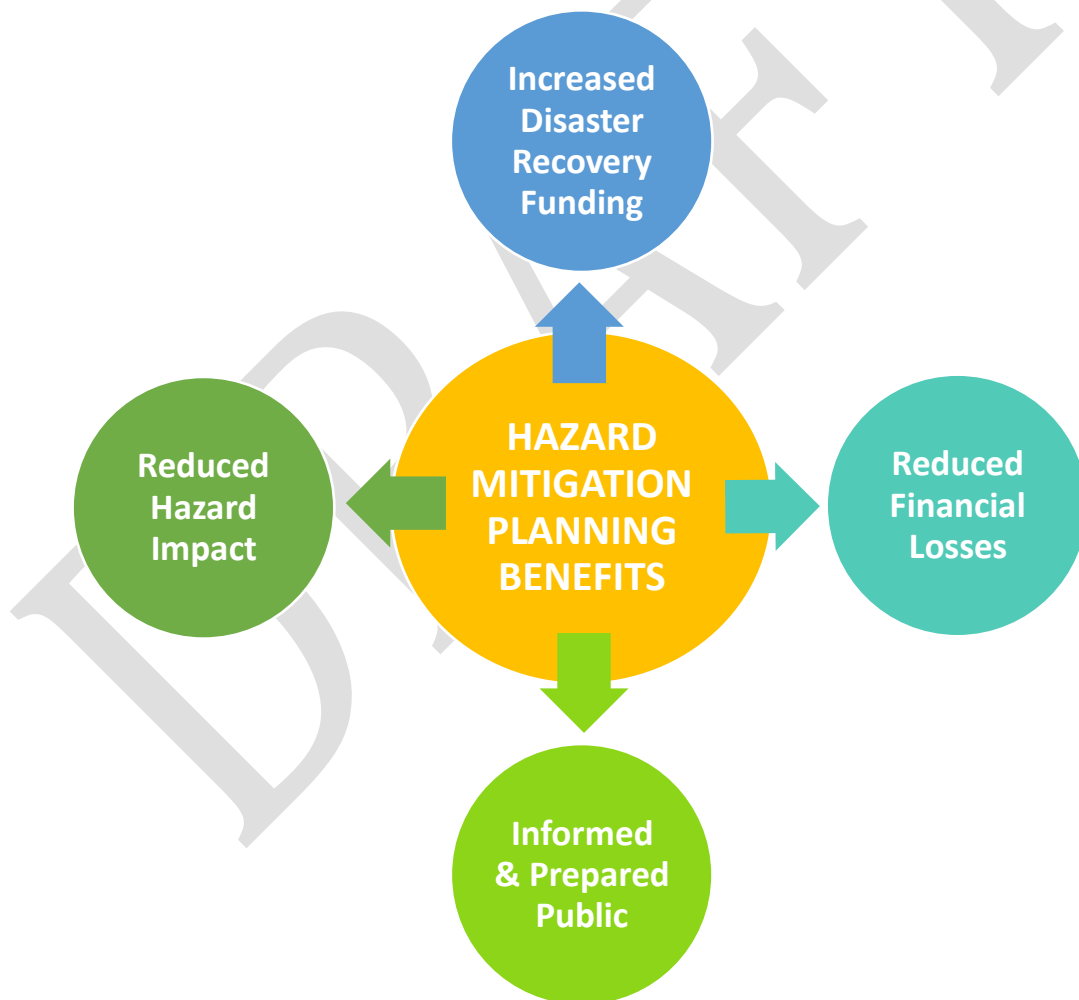
Local Hazard Mitigation Planning is the process of identifying strategies and policies to develop a long-term plan of action that will reduce or remove future risk and losses to a community caused by natural or man-made hazard events. This planning effort involved an assessment of local capabilities and resources, an awareness of historical and future hazard occurrences, an understanding of the potential impacts to life, local economy, infrastructure and the environment, and a determination of vulnerable areas and assets within the community. These efforts concluded with a list of actions that can be found in **Table 6.2-1** at the end of this plan that are to be monitored for progress over the next five-year period.

This plan will focus on assessing natural hazards and mitigating actions. The Cavendish community has provided input to this plan in the form of local and historic knowledge and experience.



## 2. PURPOSE

The Federal Emergency Management Agency (FEMA), Vermont Emergency Management (VEM), and local towns have come to recognize that it is less costly to take action to minimize the impact of natural hazards than to repeatedly repair damage after a disaster has struck. Hazards cannot be eliminated, but it is possible to determine what the hazards are, and which are more likely to occur and tend to have the greatest impact on a community. With some research and outreach, a local community can determine the extent and impact of these hazards and which assets and areas are most at risk. A culmination of these efforts is a working dynamic list of specific strategies and actions that can be taken to reduce the impact of these hazards on the community. This plan also recognizes and has identified opportunities for mitigation measures during all the other phases of emergency management: Preparedness, Response, and Recovery.



### 3. TOWN PROFILE

Cavendish is a small rural community located within Windsor County in southeastern Vermont, bordered by the towns of Baltimore, Chester, Ludlow, Plymouth, Weathersfield, and West Windsor.



Current land use in the Town follows patterns of traditional Vermont villages. The villages of Cavendish and Proctorsville are areas of high population concentration and services and are nestled along both banks of the Black River. These areas have a mixture of commercial, industrial, residential uses, and services such as post offices, health care, the elementary school and municipal offices. The village centers are served by municipal water and sewer service, while outlying areas are served by private wells and on-site septic systems. Residential areas outside the village centers are primarily rural in nature, and of low- or moderate-density.

The majority of the land area in the town is forested, much of which is owned by the State. Steep slopes, undeveloped ridgelines and large wetland areas not only add to the scenic beauty of the landscape, but are also important habitat areas for deer, moose and bear. Although only one dairy farm is still in operation in the town, many open fields and agricultural lands are also important assets to the town and add to its rural character. (See Appendix A: Map 1 – Current Land Use).

Of Cavendish’s 25,140 acres (40 sq. miles), 1,766 acres are pasture land, 971 are crop land and 18,826 are forested. The remaining 3,577 acres have been developed for residential, commercial, industrial or other planned uses. Of the forested lands, roughly 4,040 acres are state-owned lands – 2,420 acres by the Department of Fish and Wildlife and 1,620 by the Department of Forests, Parks and Recreation.

**TABLE 3-1: Cavendish Distribution of Land Cover**

Distribution of Existing Land Cover	
Land Cover Classification	Percentage of Total Land Cover
Developed*	14%
Farms and Open Fields	11%
Forested	75%
Wetlands**	4.8%

*Source: Land Cover (VCGI, LiDAR Program, 2016)*

*\*Developed land is derived from the Impervious Surfaces data set and is largely comprised of buildings and paved surfaces*

*\*\*The majority of Cavendish wetlands lie along the Black River mainstem*





Median income for Cavendish in 2020 was \$59,485, falling slightly below the Windsor County average of \$60,987.

**TABLE 3-3: Cavendish Population and Age Distribution Trend (2010-2020)**

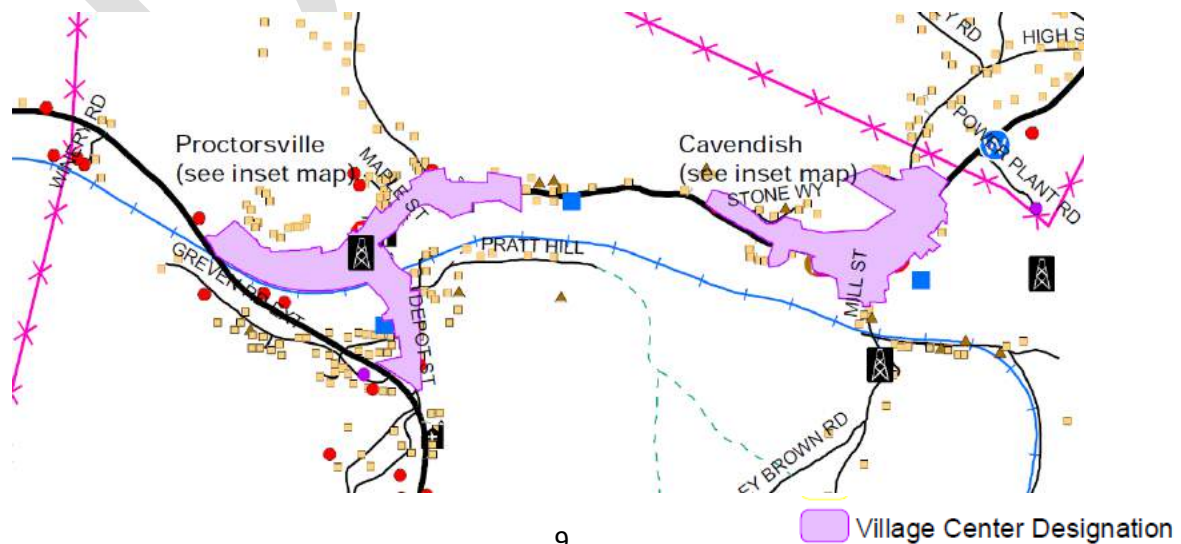
Year	2000		2010		2020	
Population	1,435		1,294		1,302	
Age	#	% of total	#	% of total	#	% of total
<5	56	4%	77	6%	89	7%
<18	232	16%	259	20%	324	25%
18-64	878	61%	803	62%	759	58%
>65	269	19%	231	18%	219	17%

Data from U.S. Census Bureau, July 2023

### Development Trends and Impact on Hazard Risk

The ongoing growth and expansion of Okemo Mountain Resort and other ski areas may put some development pressure on the town of Cavendish. Although there are no zoning bylaws or subdivision regulations in effect in Cavendish at this time, the Town is considering subdivision bylaws, in light of potential development pressure. The residents of Cavendish have expressed a desire to maintain traditional patterns of development in the town.

The population of Cavendish is not anticipated to grow significantly for the next 20 years. Therefore, many of the identified public infrastructure goals are based upon maintaining the existing facilities, such as roadway maintenance and culvert replacements, as well as evaluating the feasibility of future water or wastewater infrastructure solutions. Considering recent trends, Cavendish aims to encourage economic development in ways that reinforce revitalization of Village Centers and use of public infrastructure while maintaining rural character, and preserve/enhance quality of life. However, special consideration is taken to prohibit certain structural development in the flood hazard areas and river corridors as much of the Village areas are prone to flooding. Given the close proximity of the village centers to the floodplain, there is little opportunity for development south of Rt. 131. (See **Appendix A: Current Land Use**)



Floods are the most probable hazard event in Cavendish, with flash flooding posing the biggest risk for the upland community and inundation flooding for village communities along the Black River. **Appendix A: Map #2- SHFA Map** shows structures within the flood hazard areas.

Maintaining forest cover and minimizing impervious surfaces in rural upland and steep slope areas helps to maximize infiltration and minimize stormwater runoff to the village centers downstream. Efforts to minimize heavy cutting in forestry activities, limiting the extent and densities of developments, and properly managing stormwater in these uplands' areas will help contribute toward community flood resilience.

Cavendish's Flood Hazard Area Regulations, adopted in 2016, restrict development in special flood hazard areas and river corridors and include provisions for fifty-foot vegetated buffers along wetlands, streams, rivers, and public ponds to prevent erosion and sedimentation of surface waters.

There has been little development since the prior plan. No new primary structures have been developed in flood zone areas or river corridors and there has been no major clearing in upland areas. It can be inferred that development has not increased the Town's vulnerability to natural hazards such as flooding and fluvial erosion. **Additional information needed on specific development permits**

## 4. PLANNING PROCESS

The local planning process used to develop this hazard mitigation plan follows guidance by the Federal Emergency Management Agency (FEMA) and Vermont Emergency Management (VEM). The prior plan had expired in May, 2022, and had not been updated during the previous cycle. Since then, there has been a turnover of town management twice. The planning process began in July 2023 with the Cavendish Town Manager reaching out to municipal staff and local volunteers to participate as members of a Hazard Planning Mitigation Team (HMPT). A four-member HMPT was formed to direct the activities of the process with guidance from Mount Ascutney Regional Commission's (MARC) Community Development Specialist. All correspondence was via phone or email and meetings were conducted both virtually and in-person.

MARC staff had initial discussions with the Town Manager of Cavendish to review the overall planning process and a condensed timeline to complete a draft plan. The discussion included the need for town input, the importance of the public participation and public notice procedure, VEM and FEMA review and approval process, and the timeline to complete the update.

MARC followed up with the Team members on the planning process, roles and responsibilities with updating the plan and overseeing the public process. MARC staff were responsible for overseeing the planning process and distribution and posting of planning documents, conducting the public meetings, conducting a survey, documenting public input, updating hazard data, drafting and circulating the plan and guiding the plan through review to adoption.

Team Members from the Town and their responsibilities are listed below. All members of the HMPT were tasked with assessing and prioritizing natural hazards, providing local input, status of past actions and identifying vulnerable areas and mitigation action items for the plan.

- **Cavendish Town Manager**- provide staff to take meeting minutes, ensure public notice postings, provide information on Capabilities and Resources, Local Flood Regulations, inform Boards of progress, oversee presentation and adoption of the plan
- **Selectboard Member**-Obtain input from Selectboard and report on progress, report on past development and trends
- **Emergency Management Director**-Provide input on historical occurrences, extent of impact of previous hazard events and vulnerability of critical public facilities
- **Road Foreman**- Provide input on historical occurrences, extent of impact of previous hazard events and vulnerability of road infrastructure
- **Volunteer Fireman**- Provide input on historical occurrences and extent of impact of previous hazard events on the community at large and status of current shelter.

MARC Staff:

- Assistant Planner
- Community Development Specialist

The process began with creating a *Cavendish Climate Change Survey* which was posted on the Town website and on the Cavendish Community Facebook page. [as of 8/2 we had received 35 responses and

will leave the survey open through-out the process until final draft] A copy of the survey and summary of responses can be found in **Appendix B: Public Process Documents**. The process proceeded with the tasks and timeline as depicted in **Appendix C: 2023-2028 Cavendish Local Hazard Mitigation Plan Process Flow Chart**. Public meetings were noticed and participants recorded. The public notice, sign-in sheets of attendees, agendas and meeting minutes can also be found in **Appendix B**. A MARC weblink was created as a repository for planning and meeting documents and provided with the notice.

At the first public meeting each hazard was assessed and prioritized for the probability of future occurrence and the potential impact each would have on life, infrastructure, the local economy, and the environment. Vulnerable areas and potential mitigation actions assets were identified during the hazard assessment as part of the discussion on historical impact. (**Section 5.1: Hazard Probability of Occurrence and Impact Assessment**).

As part of the update process, the HMPT conducted a review of the status of prior plan actions and other progress made in mitigation and preparedness (**Section 4.3a: Status of Previous Plan Mitigation Actions**). Municipal capabilities and available resources for hazard mitigation planning and implementation were also discussed and suggestions made for improving effectiveness (**Section 4.3c: Status of Town Resources and Capabilities**). A thorough review of the Town Plan policies and recommendations identified common strategies which generated ideas for new mitigation actions (**Section 4.3b: Review of Cavendish Town Plan**).

MARC provided potential mitigation actions for consideration from other regional town LHMPs, technical resources listed in **Section 4.2: Resources Consulted** and from the *FEMA Hazard Mitigation Guide*.

This is an extensive rewrite of the previous plan and includes a number of revisions and improvements. The following is a partial list of revisions:

- General updates to Town profile and town maps with new graphics and visuals.
- Inclusion of an easy-to-read Process Flow Chart to depict and manage the planning process.
- Reorganization/restructuring of the plan contents to better reflect required FEMA elements.
- New table for assessing Capabilities and Resources.
- ~~New section on Vulnerable Areas and Assets (Section 5.3)~~ this section to be determined
- Reevaluation of hazards with a new methodology for scoring similar to that of the Vermont State 2018 Hazard Mitigation Plan to better recognize the integral nature of hazard events and hazard impacts and how hazards can impact a community in different ways.
- Update of hazard data using new data sources and more local data.
- Prioritization of mitigation strategies/actions and correlation to plan goals and incorporation of phasing large projects.
- Recognition of specific prior actions completed but not previously identified in prior plan.
- Review and integration of new relevant reports and documents.
- A formalized Plan Monitoring process to maintain focus on plan goals and to encourage progress, annual reporting, recording of local hazard events, identification of new vulnerable assets, and public outreach over the plan period.

## 4.1 Public Involvement

Public outreach consisted of a Hazard Mitigation Survey entitled 'Cavendish Climate Impact Survey' prepared by MARC and released to the local community of Cavendish on July 24, 2023 on the Town's Website and the Cavendish Community Facebook page. A link to the survey was also posted on the Town website with hard copies provided at the Town Office. **Results from the survey >>>>>>>>**  
\_\_\_\_\_. See **Appendix B**.

The first publicly noticed meeting, held on July 31, 2023, was noticed on the Town website, as is customary for the Town. A link inviting the public to participate in the virtual meetings was offered along with a link to agenda and meeting materials. The notice and webpage encouraged participation to attend the meeting, provide direct public comment to MARC and to complete the survey. A special invite was sent to each Selectboard and Planning Commission member.

The Town Manager and Selectboard members were tasked with keeping the Town Selectboard and relevant commissions abreast of the planning progress and noticed meetings and to help encourage participation of the public. Significant public input was received during the planning stage for hazard assessment, historical occurrences, vulnerable areas and mitigation ideas.

A preliminary plan draft was circulated to the Hazard Mitigation Planning Team and, concurrently, submitted to the Vermont State Hazard Mitigation Officer for review on August 4, 2023. A second public meeting was held on \_\_\_\_\_ to review the draft and finalize mitigation actions and a process for monitoring the plan. VEM review requirements were incorporated with public input into a revised draft and released to the public and neighboring towns for comment. A draft was made available for public viewing on the Town website and Facebook page and provided for posting to other Stakeholders, if applicable. As part of the announced release the local public and other Stakeholders were invited to a presentation and review at a noticed Selectboard meeting on \_\_\_\_\_. See **Appendix B: Public Involvement Documents** for notices and List of Stakeholders.

A final plan draft was resubmitted to completed the Vermont State Hazard Mitigation Officer review for referral to FEMA for Approval Pending Adoption (APA). Following APA, the Town may then adopt the Local Hazard Mitigation Plan and forward a copy of the adoption resolution for FEMA to complete the plan approval and adoption process. The final adopted Local Hazard Mitigation Plan will also be posted on the Town and Mount Ascutney Regional Commission websites, the Cavendish Community Facebook page and made available at the Cavendish Town Office.

## 4.2 Resources Consulted

Several plans, studies, reports, and technical information and web data sources were consulted in addition to local input during the preparation of this plan. These sources provided data on hazard extent and historical trends, and ideas for new hazard mitigation actions. A partial listing of these sources includes the following:

- Local Hazard Mitigation Plan, Town of Cavendish (Adopted April 10, 2017)
- Cavendish Town Plan (2020 Draft)
- Black River Corridor Plan, (July 2009)
- Bridge and Culvert Inventory (2016)

- Road Erosion Inventory (2017 Assessment)
- [Vermont DEC Watershed Project Database](#)
- [U.S. Census Bureau](#)
- [NOAA Storm Events Database](#)
- [Climate.gov/Climate Explorer](#)
- [EPA Climate Change Indicators](#)
- [Vermont Division of Fire Safety](#)
- [U.S. Climate Data](#)
- [USGS WaterWatch](#)
- [FEMA Disaster Declarations](#)
- [Vermont Agency of Natural Resources-Flood Ready Mapper](#)
- [State of Vermont 2018 Hazard Mitigation Plan](#)
- [Drought.gov](#)
- [Valley News, Chester Telegraph](#)
- [Vermont Transportation Flood Resiliency Planning Tool](#)
- [Cavendish Community Facebook Page](#)
- [Mount Ascutney Regional Commission for mapping data](#)

## 4.3 Review of Town Progress, Resources, and Capabilities

### 4.3a Previous Plan Period Mitigation Actions

**Table 4.3-1** below lists the mitigation and preparedness projects and actions from the previous Town of Cavendish 2016-2021 All Hazard Mitigation Plan (adopted April 10, 2017) and indicate the status of each as determined by the Hazard Mitigation Team. Eight of these 18 actions have been completed, two of which are ongoing. Two were deemed to be ineffective or unnecessary and have been dropped. The remaining reevaluated, modified, and carried forward for inclusion in **Section 6.2, Table 6.2-1: 2023-2028 Mitigation/ Preparedness Strategies and Actions** at the end of this document.

High Priority
Moderate Priority
Low Priority

**TABLE 4.3-1: Status of Previous Plan Mitigation Actions**

2016 Mitigation Action (*Indicates Action to be included in this update)	Action Type (M,P)	2023 Status
Consider VTculvert.org data, VT Road & Bridge Standards, Geomorphic Assessments, and Resident Input to Prioritize Culvert Replacement*	Mitigation/ Preparedness	Reviewed annually and ongoing.
Replace and Upgrade known undersized culverts based on above*	Mitigation/ Preparedness	Annually based on available funding and ongoing.
Actively seek funding to provide back-up power supply for town EOC/Shelter	Mitigation	Completed

2016 Mitigation Action (*Indicates Action to be included in this update)	Action Type (M,P)	2023 Status
Put in place a schedule to Identify and remove high hazard trees to reduce power outages*	Mitigation	Not done; modified and carried forward to this plan update.
Enhance outreach on safe winter home heating to homeowners, in addition to school program	Mitigation	Accomplished and ongoing.
Engage SWCRPC in Commodity Flow Study Review for incorporation into response planning	Mitigation/ Preparedness	Not done and dropped; not directly associated with Natural Hazard Mitigation.
Review and implement other recommended activities in the 'Firewise' Program	Mitigation	Completed and ongoing.
Install additional dry hydrants as needed and as funding becomes available	Mitigation	Completed
Conduct a site review of identified dam structures and determine if remedial work is needed*	Preparedness	Action is carried forward and split between river dams and beaver dams and carried forward to this plan update.
Work with State to Mediate High Hazard Stone Culvert (ID-Singleton's)*	Mitigation	Not done; carried forward to this plan update.
Implement Erosion Hazard Prevention Measures to protect Identified Critical Town Infrastructure-Sewer Lift	Mitigation	Completed
Public Outreach Program on Newly Adopted FHR with Focus on Awareness of Structures in River Corridor and FEH areas*	Mitigation/ Preparedness	Not done; carried forward to this plan update.
Improve Flood Resiliency in Davis Road Bridge Replacement Project	Mitigation/ Preparedness	Completed
Review Sensitive Areas Identified in River Corridor Plans for Consideration in Future Planning, Maintenance, and Mitigation*	Mitigation	This action has been modified and carried forward to this plan update.
Complete Black River Streambank Restoration Project	Mitigation	Had been Completed then washed out, restored and washed out again. Has been dropped as a feasible project.
Identify Properties within the River Corridor or Setbacks and Provide Information on new FHAR, NFIP, and on Flood and Fluvial Erosion Hazard Risk*	Preparedness	Not done; modified and carried forward to this plan update.
Develop a Plan to Address Citizens' Concerns Regarding Flood Risk at Impoundment Above Cavendish Gorge. Fitton Pond Restoration*	Mitigation/ Preparedness	Not completed; carried forward to this plan update.
Determine and Formalize Process for Implementing Mitigation Actions*	Mitigation	Not completed; will be incorporated into this plan update

\*2016 Mitigation Actions carried over to this update and listed in **Table 6.2-1: 2023-2028 Mitigation/Preparedness Strategies and Actions.**

### 4.3b Review of Town Plan

The Cavendish Town Plan was updated in 2020 but has not yet been adopted. Compared to earlier plans, the community is making strides in its efforts to address sustainable development, natural resource



conservation, flood resiliency, and hazard mitigation. The current Town Plan includes information that outlines the importance of:

- Maintaining wetlands
- Maintaining rural upland areas to minimize storm runoff
- Discouraging and preventing new residential and commercial structures in the special flood hazard areas and river corridors
- Regulating further “development” or improvements to existing primary structures within flood hazard areas and river corridor
- Regulating “development” which may increase the susceptibility of that or other properties to fluvial erosion damage or the potential of materials being swept into the stream or onto other lands
- Creating and maintaining minimal vegetative buffers along wetlands, streams, rivers, and public ponds
- Continuing to create adequate culvert and bridge sizing
- Community outreach on flood resiliency, preparedness and mitigation

The Town Plan has outlined goals, policies, and recommendations related to hazard mitigation which can be found in **Appendix D**. Upon review, the HMPT has identified mitigation strategies and actions that will meet objectives for both the Town and Hazard Mitigation Plans. These proposed actions can be found as noted in **Section 6.2, Table 6.2-1: 2023-2028 Mitigation/Preparedness Strategies and Actions**.

Cavendish currently participates in the National Flood Insurance Program (NFIP) and will continue to regulate floodplain use through the **Flood Hazard Area Regulations** as adopted in 2016. These regulations apply to the Special Flood Hazard Areas, as determined by the most current published flood insurance maps by NFIP/FEMA, and to the River Corridor as determined on the most current River Corridor Map published by the Vermont Agency of Natural Resources. Base flood elevations and floodway limits provided by NFIP and in the Flood Insurance Study and accompanying maps are used to administer and enforce these regulations. The Town Manager acts as the Administrative Officer and is charged with implementing these regulations and advising residents on floodplain development.

### **4.3c Community Resources and Capabilities**

**Table 4.3-2** below is a compilation of community resources and capabilities including town authorities, policies, and programs, which can be helpful in reducing hazard risk for the Cavendish community. Opportunities for improvement have been identified. These resources and capabilities are useful in regulating development, building design, environmental conservation, and best management practices to reduce flooding and erosion.

Some Improvement Opportunities noted in **Table 4.3-2** have been added as action items for this plan update and can be found in **Section 6.2, Table 6.2-1: 2023-2028 Mitigation/Preparedness Strategies and Actions**



**TABLE 4.3-2: Status of Community Resources and Capabilities**

\*\* Denotes Improvement Opportunities that have been recognized as an action item in this plan update)

Plans & Studies	Description	Improvement Opportunity
Town Plan	Plan for coordinated town-wide planning for land use, municipal facilities, housing, transportation, etc. Updated every 8 years. Current draft is 2020.	Incorporate hazard mitigation recommendations into each Town Plan section, if applicable.**
Local Hazard Mitigation Plan (LHMP)	Plan for town-wide mitigation planning for hazard events and impacts. Updated every 5 years.	Begin update process earlier to avoid expiration and formalize annual review process to plot progress during plan period.
Stormwater Plan	No existing plan.	A Stormwater Master Plan could determine whether better management of stormwater runoff from uplands would be beneficial at reducing flood risk.
Local Emergency Management Plan (LEMP)	Basic state managed municipal procedures for emergency response. Updated annually.	Public posting of management plan each update to raise awareness.
School Emergency Response Protocol	School procedures for emergency response provided by the state for school administrators and first responders.	Coordinating response procedure among planning tools may improve effectiveness.
Forest Management Plan(s)	No existing plan.	Not enough municipal staff to oversee if developed.
Invasive Species Management Plan	No existing plan.	Potential for a resident to take on if funds are provided to develop and there is interest.
Capital Improvement Plan	Municipal plan to coordinate financing of capital improvements over a 5-year period.	Incorporate a review of plan mitigation actions during budget process.
Culvert Inventory (VT Culverts)	Statewide program to collect and report culvert locations and conditions every 3 years.	Incorporate a study on vulnerable areas of repetitive washouts each inventory cycle to determine if further upgrades or additional culverts are needed beyond standards.**

Administrative	Description	Improvement Opportunity
Emergency Management Director	The Emergency Management Director has direct responsibility for the organization, administration, and coordination of the local organization for emergency management.	No recommendation.
Planning Commission	Cavendish does currently not have Zoning or Subdivision Regulations. MARC assists with Town Plan and FHRA updates.	Consider subdivision regulations.
Zoning Administrator	The Cavendish Town Manager assumes the role of administrative officer (AO) responsible for administering the Zoning and Subdivision regulations, to include Flood Hazard Area regulations.	Consider retaining an experienced professional to advise and assist in administering Flood Hazard Area Regulations.**

<b>Tree Warden</b>	Cavendish does not have a tree warden.	No recommendation.
<b>Selectboard</b>	Cavendish has a 5-member governing body has general supervision and control over the affairs of the Town and meets monthly.	Include an annual review of progress on Local Hazard Mitigation Plan actions during a Selectboard meeting.**
<b>Mutual Aid Agreements</b>	Agreement for regional coordinated emergency services and emergency highway support and resources during atypical events.	Agreements are formalized and maintained. No recommendation.
<b>VEM Training</b>	Training opportunities are provided via in-person and online courses administered through the Learning Management System (LMS).	Emergency Management Director position can benefit from participation.
<b>Highway Department</b>	Town Department responsible for maintaining Town roads and right of ways in accordance with VT's best management standards.	Proactively seek available grant funding to improve flood resiliency.**
<b>Health &amp; Safety</b>	Cavendish has an individual that addresses public health hazards and health risks.	May be an opportunity for public outreach on risk of natural hazards to public health & safety.
<b>Fire &amp; Rescue</b>	Cavendish has two volunteer fire departments and participates in a mutual-aid program for emergency response.	Department Facebook page can be effective for Hazard Mitigation Planning outreach.
<b>Town Clerk/ Manager/ Administrative Assistant</b>	Town Official responsible for recording and filing of all Town documents	No recommendation
<b>Town Planner</b>	Cavendish does not have a town planner and uses the Regional Planning Commission for these services.	No recommendation.

<b>Financial Resources</b>	<b>Description</b>	<b>Improvement Opportunity</b>
<b>Town Budget</b>	Fiscal spending plan that operates on a fiscal year of July 1 <sup>st</sup> through June 30 <sup>th</sup> .	No recommendation.
<b>Capital Improvement Plan</b>	A plan of capital projects proposed to be undertaken during each of the following five years.	No recommendation.
<b>Municipal Bonds</b>	A bond or note or evidence of debt constituting a general obligation of the municipality.	No recommendation.
<b>Taxing Authority</b>	The Town; any governmental authority responsible for the administration of local taxes.	No recommendation.

<b>Outreach and Education</b>	<b>Description</b>	<b>Improvement Opportunity</b>
<b>Town Newsletter</b>	Routinely distributed newsletter containing information and resources for residents. Town uses a community Facebook page which has worked well for public outreach.	No recommendation.

<b>Town Website</b>	Official Town website for community information. Town uses website for posting meeting and relevant town documents and for general public news and outreach.	No recommendation.
<b>Town Facebook Page</b>	Official Town Facebook page for community information. Town has a community Facebook page that has worked well for public outreach.	No recommendation.
<b>Water Bill</b>	Municipal bill sent to individual residences on a periodic basis.	Can use the opportunity to provide outreach materials related to hazard mitigation.

<b>Zoning &amp; Regulations</b>	<b>Description</b>	<b>Improvement Opportunity</b>
<b>National Flood Insurance Program (NFIP)</b>	Provides ability for residents to acquire flood insurance; Town enrolled since 1985.	Improve outreach efforts to residents and businesses in flood hazard areas on the NFIP program and flood mitigation information to increase participation.**
<b>SFHA bylaws</b>	Regulates development in FEMA flood hazard areas. Cavendish has Flood Hazard Area Regulations (FHAR) that regulate development in SFHAs and river corridors with setbacks. A permit is required for all development in these areas. Last adopted in 2016.	Public outreach on these regulations can improve effectiveness of implementation and enforcement.**
<b>Zoning</b>	Regulates development. Cavendish has no zoning.	No recommendation.
<b>Road Standards</b>	Design and construction standards for roads and drainage systems. Effective at tracking and planning infrastructure upgrades.	Improve efforts to comply with MRGP to help reduce risk of road erosion and washouts.**
<b>NFIP CRS</b>	A voluntary incentive program that recognizes and encourages community floodplain management practices that exceed the minimum requirements of the NFIP.	Review the benefits and requirements of the program to determine whether participation is of interest.
<b>Wetland Protections</b>	Regulates development in wetland areas. State regulated and incorporated in Cavendish FHAR.	No recommendation.
<b>River Corridor bylaws</b>	Regulates development in River Corridors as determined by VT ANR. River Corridor regulations are incorporated in Cavendish FHAR.	Public outreach on these regulations can improve effectiveness of implementation and enforcement.**
<b>Green infrastructure bylaws</b>	Regulates development. Cavendish has no development review board or bylaws regulation development.	No recommendation.
<b>Building Codes</b>	Under state purview by the Vermont Fire and Building Safety Code section 7 (1) requiring a construction permit be obtained before beginning any construction. Cavendish FHAR may regulate building construction or flood damage repair or rebuild per NFIP.	No recommendation.
<b>Access Permits</b>	Cavendish regulates driveway access development.	Consider revising to require better flood resiliency to reduce erosion and

DRAFT

## 5. HAZARD IDENTIFICATION and ASSESSMENT

This Section describes the process used to identify the natural hazards that are likely to have the greatest impact on the community in the future and provides a basis for the selected mitigation strategies and actions listed in **Table 6.2-1: 2023-2028 Mitigation/Preparedness Strategies and Actions**.

The following assessment addresses all of the natural hazards identified during the hazard analysis. The probability of occurrence and impact to the town were used to assess the town's vulnerability to each hazard and can be found in **Section 5.1**. Following this assessment, it was determined that only those hazards that were more likely to occur were further examined for historical occurrence, extent of impact, future trends and community risk as outlined in **Section 5.2**.

### 5.1 Hazard Impact Assessment

A hazard impact assessment for Cavendish began with identifying all possible natural hazards as addressed in the *2018 Vermont State Hazard Mitigation Plan*. Prior to the exercise, MARC discussed the difference between a weather event and the hazards, or impact of these weather events. For example, **Wind** is a natural hazard which can impact a community from different types of weather events: Hurricanes, Thunderstorms and Winter Storms; **Erosion and Flooding** can result from Tropical Storms, Thunderstorms, Ice Jams or spring melt from an extreme heat event during the winter. This discussion also allowed for better understanding of the relationship between these natural hazards and on the secondary hazards, such as structure fire, power outages, and ice jams.

#### Types of Hazards and Potential Impacts:

Fluvial Erosion/Erosion	Landslides/Slope Failure	Inundation Flooding
Ice/Ice Jam	Heavy Snow	Hail
Extreme Heat/cold	Drought	Wildland/Structural Fire
High Wind	Lightning	Infectious Disease
Dam Failure	Invasive Species	Transportation Incidents
Water Contamination	Power Outage	

Input from the Climate Survey and the first public meeting was used to determine a **Probability of Occurrence Score** for each natural hazard for the Cavendish community. The group considered the historical trends of and expected changes in climate to determine the probability of occurrence in the future. The potential severity and extent of damage and disruption to public infrastructure, economy, natural environment, and quality of life which includes damage to personal property and potential for injuries. These scores were averaged and used to generate an overall **Hazard Assessment Score** for each natural hazard as shown in **Table 5.1-1: Hazard Probability of Occurrence and Impact Assessment**. The methodology used for this exercise is detailed below the table.

**TABLE 5.1-1: Hazard Probability of Occurrence and Impact Assessment**

Hazard Impacts	Probability of Occurrence Score	Potential Hazard Impact (Score 1-4)					Hazard Assessment Score
		Public Infrastructure	Life & Property	Economy	Natural Environment	Avg.	
Inundation / Flash Flooding	4	3	1	3	3	2.50	10.00
Fluvial Erosion	4	3	1	2	4	2.50	10.00
Slope Failure	2	1	1	1	1	1.00	2.00
Ice	4	2	2	1	1	1.50	6.00
Heavy Snow	3	1	1	1	1	1.00	3.00
High Wind	3	2	1	1	1	1.25	3.75
Hail	1	1	1	1	1	1.00	1.00
Lightning	2	1	1	1	2	1.25	2.50
Extreme Heat	3	1	2	1	1	1.25	3.75
Extreme Cold	2	1	2	1	1	1.25	2.50
Wildland Fire	1	1	1	1	2	1.25	1.25
Earthquake	1	1	1	1	1	1.00	1.00
Drought	2	1	1	1	2	1.25	2.50
Invasive Species	3	1	1	1	1	1.00	3.00
Infectious Disease Outbreak	1	1	2	3	1	1.75	1.75

**Probability of Hazard Occurrence - Scoring Methodology**

**Probability of Future Occurrence:** Probability of occurrence over the next 5 years

- 1 = Not Likely                      Not expected or unlikely to occur during the plan period
- 2 = Occasionally                  Could plausibly occur at least once every 5 years
- 3 = Likely                            Likely to occur in any one year
- 4 = Highly Likely                   Highly likely to occur at least once in any one year

**Potential Hazard Impact - Scoring Methodology**

**Potential Impact:** Probability of a Significant Impact defined as ‘Severity and extent of damage and disruption to population property, environment and the economy’

- 1 = Negligible      Isolated occurrences of minor property and environmental damage, minor disruption of critical facilities and infrastructure, potential for minor injuries, no to minimal economic disruption
- 2 = Minor            Isolated occurrences of moderate to severe property and environmental damage, brief disruption of critical facilities and infrastructure, potential for injuries, and minor economic disruption
- 3 = Moderate        Severe property and environmental damage on a community scale, temporary shutdown of critical facilities, injuries or fatalities, short-term economic impact
- 4 = Major            Severe property and environmental damage on a town-wide or regional scale, shutdown of critical facilities, and/or multiple injuries or fatalities, significant economic impact

## 5.2 Hazard Profile

While the assessment scores in **Table 5.1-1** are not intended to prioritize hazard risk, they can be used to get a general sense of which hazards are of greatest concern to the Cavendish community. The HMPT had determined that only those natural hazards which scored over a "3" out of a possible 16 were considered for mitigation and are highlighted in the **Table** above. These and other hazards which are trending higher in the region due to climate change, as determined in the 2018 Vermont State Hazard Mitigation Plan, are profiled in this plan in **Section 5.2**.

Subsections provide additional detail of each of these natural hazards and include a description of the hazard and its general impact on a community; a discussion of historical local occurrences and extent of the hazard impact based on available data; hazard trend and discussion of vulnerability and populations and community assets at risk. Cavendish is a small rural town, and much of the town-specific data for these natural hazards does not exist. Previous occurrence hazard data specific to Cavendish has been provided where available. Where no town-specific data exists, the most relevant available data or information has been provided, such as county, regional or state data, or data from a neighboring town.

### Excluded Hazards

For purposes of the plan update, the following hazards have been excluded from detailed discussion given that the likelihood of occurrence is either very low with no account of recent local occurrence or the hazard impact is very isolated or minimal as described below. For more information on these hazards, the reader is directed to the [2018 Vermont State Hazard Mitigation Plan](#).

**Slope Failure** can be a real threat along river corridors as a result of erosion and from stormwater runoff over valley walls during heavy and persistent rain events. Should they fail and block an underpass, or roadway some isolated flooding could occur. Slope failure in the Cavendish Gorge area is possible, however, this would not have a direct impact on the Town. The recent July 2023 flood event did, however, create a landslide or slope failure along Rt. 103 in Proctorsville which blocked the Route for a day and required clearing.

**Heavy Snow** is likely to occur in any given year and potentially more than once a year. However, for the Town of Cavendish, as with most rural towns in Vermont, this is a way of life and the community is accustomed and well equipped to handle these events.

**Hail** and **Lightning** do occur but very rarely and have not resulted in reported damage to the Town of Cavendish. These incidents are very difficult to predict or mitigate and can only be addressed through preparedness and effectiveness of emergency response. Regional weather warnings and safety measures are issued when an extreme event is projected. The Town indicated that homeowner's insurance provides sufficient assistance with any damages.

There is a potential for **Wildland Fire** in rural regions that are heavily forested, such as Cavendish, however representatives from the Fire Department indicated that there had not been a real wildland fire in Town in decades. Most incidents are related to brushfires ignited by human initiated burn piles particularly in the early spring before green-up. 'No Burn' events are well posted and noticed and are at times extended, if need be, during the spring months.

Although **Earthquakes** can be a significant hazard, the likelihood of occurring in Cavendish over the plan period would be negligible for New England per the Vermont State Hazard Mitigation Plan. Local regional recollection of this type of hazard occurring has been the sensation of minor tremors felt from distant events.

**Drought** is recognized as a natural hazard and trending higher due to climate change. However, Cavendish has rarely experienced this hazard over the past several years with minor isolated impact from residents with dug wells.

Plant Infestations from **Invasive Species** due to climate change are beginning to gain recognition. While more information is needed, the Town recognizes that this could become a hazard for town roads and infrastructure and has impacted the Town's vulnerability to flooding and erosion due to shallow rooted Japanese Knotweed in riverbeds.

**Infectious Disease Outbreak** is defined by the Vermont Department of Health as one that is caused by micro-organisms, such as bacteria, viruses and parasites as noted in the State Hazard Mitigation Plan. A Covid-like pandemic may be plausible but is unlikely to occur during the plan period. While Tick borne diseases have been experienced and will continue to be a seasonal challenge, the Cavendish residents believe protection from this hazard risk is local common knowledge.

### Changes from Prior Plan Hazard Assessment

A comparison was made to the prior plan's hazard assessment with notable changes listed below. Changes in the methodology used for the hazard assessment exercise and recent and trending climate extremes in wind, temperature and precipitation events are reflected in these differences.

- Flooding, both inundation from the Black River and flash flooding from upland tributaries continue to be a priority given the Town's geographical characteristics and concentration of development near flood hazard areas and the river corridor;
- High Wind is now identified separately as a significant hazard impact from winter storms and severe weather events with a high probability of occurrence and prevalence of higher wind gusts.
- Wildland Fire has been dropped as a priority hazard given a low probability of occurrence over the past several years and isolated or minimal potential impact to the community.
- Extreme Heat and Extreme Cold have increased in priority primarily due to an increase in probability of occurrence and duration of events with climate change. The aging of Windsor's residents, a more vulnerable population, was also a consideration.
- Ice Jams and Dam Failure are now recognized as potential impacts or secondary events due to infrastructure deficiencies and are covered under Flooding, the primary natural hazard that triggers them, such extreme temperature fluctuations during the winter season.
- Structure Fire is now recognized as a secondary human-caused incidents that can result from a natural hazard occurrence. The Town recognizes that these incidents may be secondary hazards to Wildland Fire, lightning, drought, and improper heating methods during extreme cold and can be addressed or reduced through mitigation of these natural hazards. Brush Fire has been incorporated into Wildland Fire.



- Transportation incidents and Hazardous Material Spill are not considered natural hazards by FEMA although they are closely tied to road conditions following a hazard event. Therefore, the Town recognizes that transportation related hazards would be addressed through mitigation of natural hazards such as ice and heavy snow.
- **Variability** in temperatures, as well as the extremes for heat or cold, was discussed by the Town and worth noting here. Several remarked that the variability during the fall, winter, and spring seasons has become a trigger for the frequency of several hazards such as ice, heavy snow, ice jams, flooding and erosion.

### Regional Overview

The types of hazards having the greatest impact on a regional basis can be gleaned from **Table 5.2-1**, a listing of **FEMA Disaster Declarations for Windsor County** since 1990. It can be seen from this table that these are typically severe storms with heavy rains that cause flooding.

**TABLE 5.2-1: Federal Disaster Declarations for Windsor County VT<sup>1</sup>**

<b>Federal Disaster Declarations: Windsor County 1990 – 2023(current)</b>			
<b>FEMA Disaster Number</b>	<b>Date of Declaration</b>	<b>Description</b>	<b>Date Occurred</b>
DR-4720-VT	July 14, 2023	Severe Storm and Flooding	July 7, 2023
EM-3595-VT	July 10, 2023	Vermont Flooding	July 9, 2023 (statewide)
EM-3567-VT	August 22, 2021	Tropical Storm Henri	August 22, 2021 (statewide)
DR-4532-VT	April 8, 2020	Vermont COVID-19	January 20, 2020
EM-3437	March 13, 2020	Vermont COVID-19	January 20, 2020
DR-4445-VT	June 14, 2019	Severe Storms and Flooding	April 15, 2019
4330	August 16, 2017	Severe Storms and Flooding	June 29, 2012
4207	February 3, 2015	Severe Winter Storm	December 9-12, 2014
4140	August 2, 2013	Severe Storms and Flooding	June 25-July 11, 2013
4022	September 1, 2011	Tropical Storm Irene	August 27-September 2, 2011
1790	September 12, 2008	Severe Storms and Flooding	July 21-August 12, 2008
1715	August 3, 2007	Severe Storms and Flooding	July 9-11, 2007
1698	May 4, 2007	Severe Storms and Flooding	April 15-21, 2007
1488	September 12, 2003	Severe Storms and Flooding	July 21-August 18, 2003
1336	July 27, 2000	Severe Storms and Flooding	July 14-18, 2000
1307	November 10, 1999	Tropical Storm Floyd	September 16-21, 1999
1228	June 30, 1998	Severe Storms and Flooding	June 17-August 17, 1998
1101	February 13, 1996	Storms and Flooding	January 19-February 2, 1996
938	March 18, 1992	Flooding, Heavy Rain, Ice Jams	March 11, 1992

<sup>1</sup> [FEMA Disasters Declaration Website, Accessed 7-20-2023](#)

## 5.2a Wildland Fire

Hazard Assessment Score: 1.25

**Wildland Fire** was identified as a notable hazard for the Town primarily because of the high probability of occurrence, although the impact of fire incidents is typically isolated.

**Wildland Fires**, which for discussion here include forest, brush, crop or grassland fires, are defined as “An uncontrolled burning of woodlands, brush or grasslands.”<sup>2</sup> While relatively uncommon within Vermont and the Town of Cavendish, large **wildland fires** are always a threat particularly for rural communities with large tracts of forested and vegetative land and have the potential to damage structures and utilities and croplands. A major Wildland Fire can leave a large amount of scorched and barren land susceptible to erosion for many years, particularly on steep slopes and ridgelines.



### National Weather Service Criteria for Issuing a 'Red Flag Warning'

- Winds sustained or with frequent gusts > 25 mph
- Day Relative Humidity at or below 30%
- Rainfall for the previous 5 days less than 0.25"
- Lightning after an extended dry period
- Significant dry frontal passage dry thunderstorms
- Keetch-Byram Drought Index values of 300 or greater (in summer)

Wildland Fire hazard can result directly from natural events such as lightning, particularly during periods of extended drought and extreme heat. These conditions provide more surface fuel for combustion and can extend underground along tree root systems following extended periods of drought. More often uncontrolled burns occur from a combination of dry conditions, high winds and human neglect or other human influences. Improperly disposed fire ashes and lit cigarettes are common causes.

Unintentional human causes would include sparks from downed power lines, railcars and other vehicles or farm equipment. Continued and consistent enforcement of 'red flag' warnings is used to restrict controlled burning during the dry seasons.

### Wildland Fire History and Extent of Impact

The State Hazard Mitigation Plan's analysis of Wildland Fire threat states that “*Wildland Fire conditions in Vermont are typically at their worst either in spring when dead grass and fallen leaves from the previous year are dry and new leaves and grass have not come out yet, or in late summer and early fall when that year's growth is dry*.”<sup>3</sup> Wildland Fires can be ignited by lightning during a thunderstorm; however, this is rare in Vermont. More typically, brush fires or burning debris are the major causes for igniting wildland fires, according to the Vermont Department of Forests, Parks, and Recreation.

<sup>2</sup> 2018 Vermont State Hazard Mitigation Plan

<sup>3</sup> 2018 Vermont State Hazard Mitigation Plan

According to the State of Vermont Hazard Mitigation Plan, “There has not been a major Wildland Fire in Vermont in the last 50 years. Vermont has a reliable system of local fire suppression infrastructure coordinated at the state level. Vermont’s climate, vegetation type, and landscape discourage major Wildland Fire.”<sup>4</sup>

In addition to a Wildland Fire event reported in NOAA’S Storm Events Database in Windham County, just south of Cavendish, the following incidents have been locally reported:

- 26-acre forest fire in Andover, a neighboring town, caused by a re-kindled brush fire;
- 47-acre forest fire in Brattleboro, sparked by a downed powerline;
- 137-acre forest fire in Norwich, also caused by a downed powerline; and
- 1/3 acre in Killington in 2021 that continued burning underground for three days.

Wildland fires are reported in the annual Vermont State Fire Marshal Report, which provides yearly fire statistics from FEMA’s Nation Fire Incident Reporting System (NFIRS). **Table 5.2-2: Fire Statistics for Vermont, Windsor County and Town of Cavendish** shows historical fire reporting data for Vermont, Windsor County and the Town of Cavendish as reported to NFIRS.

The fire statistics reported by the State Fire Marshal, as of 2015, no longer breakout data for Wildland Fire separately. Instead, the NFIRS Series 100 is reported and includes other types of fire incidents as noted. It can be estimated from **Table 5.2-2** that there is an average of 7 wildland fires reported for Cavendish, however, according the Cavendish Village Fire Department these were minor brushfire incidents and that no major wildland fires in Cavendish during this period or in the last several decades

The average Wildland Fire impact in Vermont between 2012 and 2016 was 109 fires and 317 acres per year, or 2.9 acres per Wildland Fire incident.

**TABLE 5.2-2: Fire Statistics for Vermont, Windsor County and Town of Cavendish<sup>5</sup>**

YEAR	Vermont		Windsor County	Cavendish
	Fire-NFIRS Series 100 <sup>4</sup>	Wildland Fire Responses	Wildland Fire Responses	Wildland Fire Responses <sup>3</sup>
2010	-	475	70	6
2011	-	1144	70	20
2012	-	667	101	13
2013	-	625	86	6
2014	-	470	61	7
2015	3575	-	89	9
2016 <sup>1</sup>	3269	-	-	3
2017	2458	-	-	2
2018	2660	-	-	4
2019	2274	-	-	4
2020	2693	-	-	6
2021	2376	-	-	3
Annual Average <sup>2</sup>				<b>7</b>

<sup>4</sup> 2018 Vermont State Hazard Mitigation Plan

<sup>1</sup>As of 2016, the Vermont Fire Marshall Report no longer reports fire statistics by county nor by fire type.

<sup>2</sup>Annual Averages are based on available data shown in table.

<sup>3</sup>Cavendish data from the Town for both Proctorsville and Cavendish Firehouse.

<sup>4</sup>Total NFIRS Series 100 incidents include Fires, Overpressure Rupture/Explosion/Overheat (No Ensuing Fire), Rescue & Emergency Medical Service (EMS) Incidents, Hazardous Condition (No Fire), Service Calls, Good Intent Calls, False Alarm and False Calls, Severe Weather and Natural Disasters, Special Incident Type, N/A

## Wildland Fire Trends and Vulnerability

Wildland and brush fires pose a unique danger to local rural communities and controlling them can be challenging given a small town's limited capacity to respond to a major Wildland Fire. The greater hazard for Cavendish is the smaller, uncontrolled brush fires which may burn between 1 and 10 acres if uncontrolled.

Wildland Fires can threaten people who are living in remote forested areas. Protecting these structures from fire poses special problems, given the longer response time and limited resources. In addition to precipitation, a particular town's vulnerability to large Wildland Fires is directly related to the proportion and continuity of acreage that is forested, pasture and cropland. In Cavendish, this represents 75% of total town land cover. It can be anticipated that small brush and Wildland Fires will continue to occur throughout the Town of Cavendish at a similar rate in coming years, however, given the current land cover and correct seasonal conditions the threat of a large Wildland Fire remains. (See **Appendix A: Map 1-Current Land Use**). The Town encourages new development in or near village areas in order to preserve these natural resources and conserve municipal infrastructure resources. This policy also helps to reduce the risk of structure damage losses to Wildland Fire.

Vermont is seeing an increase in the average annual maximum temperature and likelihood of drought (See **Section 5.2e**). These trends are also recognized by the Cavendish HMPT. According to the State Plan, only five statewide burning bans have been issued over the last 55 years since 1965. Four of those were over the last 22 years in 1999, 2001, 2005-2006, and most recently in 2012, supporting the trend toward drier conditions and increasing the risk of a major Wildland Fire.

Local education and outreach programs continue to be the most effective way to reduce a community's risk to fire. [Firewise](#), is a community outreach program through the National Fire Protection Association that provides guidance, resources, and training on protecting homes and property from wildland fire. [Smokeybear.com](#) provides information for the prevention of Wildland Fire geared towards kids' education, residential home burning tips and campfire safety. The Vermont Annual Fire Marshal Report also offers informational resources for municipalities and property owners regarding fire safety. In addition, the [Vermont Division of Fire Safety](#) conducts a number of public educational events throughout the state and provides a toolbox of resources to educate communities which the town takes advantage of continuously and annually.

## 5.2b. Inundation & Flash Flooding

Hazard Assessment Score: 10.0

## Fluvial & Other Erosion

Hazard Assessment Score: 10.0

**Flooding**, including **flash flooding** and overbank or **inundation flooding**, and **Fluvial Erosion** are significant natural hazard events for Vermont and Windsor County. Both **Flooding** and **Fluvial Erosion** have a high probability of occurrence and directly impact mostly those properties located near or in flood prone areas. However, during severe events they can indirectly impact the whole community. Both hazards are profiled here as they are intrinsically linked.

**Flash flooding** can occur near smaller upstream tributaries in mountainous terrain. It is characterized by intense, high velocity torrent of water moving downstream following a heavy rainstorm. Flash floods are very dangerous and destructive causing severe land erosion and property damage. This type of flooding threatens high-elevation drainage areas call alluvial fans where water transitions from steep grades to flatter terrain. These events typically occur during summer when a single or series of weather events result in excessive rainfall over a short period of time on already saturated soils from a spring melt. Flash floods can also be triggered by a dam breach causing further damage downstream.

The damage from spring flooding events can vary greatly depending upon the amount of precipitation, snow cover, spring melt, soil saturation, existing erosion, and topography. Road infrastructure within the narrow stream valleys receive drainage from the higher elevations and are often the most vulnerable to damage from flash flooding.

**Inundation Flooding** occurs in lower lying areas when water levels rise overflowing the banks of a river or lake. In hilly or mountainous areas, drainage from higher elevations flows to the lower reaches or valleys of a watershed causing these waters to rise quickly. Instances of inundation type flooding can occur long after precipitation has ended or when no precipitation has occurred, such as an extreme winter warming event causing river ice to melt resulting in ice jams obstructing the flow of river waters. These waters often carry with it debris which can block culverts or a bridge underpass exacerbating flooding.

Stable river channels naturally meander adjusting with periodic flooding. Floodwaters will rise and enter low lying **floodplain** areas temporarily which lessen the volume and velocity of water flowing downstream reducing the flood risk to downstream properties, villages and town centers. When floodwaters are restricted from their natural corridor, water velocity increases and **fluvial erosion** occurs with the scouring of riverbeds and riverbanks as the river tries to adjust. This action destabilizes nearby roads, bridges, residential properties and other man-made structures built within the river's natural corridor.

### Flood Zones Explained

The Federal Emergency Management Agency (FEMA) has designated flood zones, as defined below. The designated *Special Flood Hazard Areas* (SFHA) have the highest risk of flooding. These areas include the floodway and the river's floodplain.

Flood Zone Definitions	
Floodway	The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water



	surface elevation more than a designated height; also known as the regulatory floodway. As designated and determined by FEMA.
Special Flood Hazard Area (SFHA)	The land in the flood plain within a community subject to a 1 percent or greater chance of flooding in any given year; also known as <b>floodplain</b> . As designated by FEMA. Key part of the <i>National Flood Insurance Program</i> (NFIP). Includes Floodway Fringe (Zone A and Zone AE).
River Corridor	The land area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition and for minimization of fluvial erosion hazards. Generated automatically as a 50-foot buffer on each side of the meander belt width. As delineated by the Agency of Natural Resources in accordance with river corridor protection procedures. (See figure below)
Fluvial Erosion	The erosion or scouring of riverbeds and banks during high flow conditions of a river. Fluvial erosion can be catastrophic when a flood event causes a rapid adjustment of the stream channel size and/or location. These areas are found within the River Corridor.

The land area that a river accesses to meander and overtop its banks to release flood energy without excessive erosion is known as the **River Corridor**. This is a depiction of a typical stream with its River Corridor area highlighted and an example of the meandering pattern of the stream over time within that corridor.



Areas within the river corridor are considered areas of both flood and erosion risk as rivers and streams seek equilibrium in accommodating the high flows causing major flood and erosion damage even outside of SFHAs. Flood damage within and outside of the river corridor is becoming more frequent due, in part, to the relative frequency of these storms which continue to scour unvegetated streambanks before they've had the time to regenerate and also to remaining loose debris in streambeds that are washed downstream blocking bridges and culverts causing flooding in these atypical areas.

Vermont Agency of Natural Resources has mapped SFHAs and River Corridors for the Black River and its tributaries and can be found on-line.<sup>5</sup> River Corridors are currently being modified to reflect the valley topography more closely and will allow for improved identification of elevated fluvial erosion hazard areas.

**Fluvial Erosion**, which often accompanies flood events, is the predominant form of flood damage in Vermont and in mountain valley towns like Cavendish. Rivers are dynamic and move both water and sediment. As a result, river channels may move vertically or horizontally. High flows can cause sediment to become detached from a riverbed or riverbank, which can range from gradual bank erosion or massive slope failure to catastrophic changes in river channel location and dimension. The sediment and stone

<sup>5</sup> The ANR FLOOD READY link shows river corridors overlays and FEH zones, [http://floodready.vermont.gov/assessment/vt\\_floodready\\_atlas](http://floodready.vermont.gov/assessment/vt_floodready_atlas).

that is dislodged can expose tree roots and wash away vegetative buffers which are carried downstream blocking culverts and bridges causing further flood damage.



Vermont is vulnerable to this hazard because of its topography, extreme climate, deep snows, destructive ice jams and intense rainstorms. Centers of commerce in villages and towns became concentrated along riverbanks, and over time as forests were cleared, many rivers moved or were channelized to accommodate this development rendering them unstable and prone to fluvial erosion.<sup>6</sup> Fluvial erosion can severely threaten mountain communities like Cavendish as most rural town development lies in valley areas along rivers and streams.

**Ice Jams** can also cause a secondary event of flooding and threaten many of the same properties located within the FEMA Special Flood Hazard Area. Common in New England, ice jams occur during winter and spring months when river water levels rise, or a spring or mid-winter thaw breaks the ice into large chunks which become jammed at manmade and natural obstructions. Ice can build up against bridge abutments and expanses, undersized structures, and other obstructions to create a temporary dam impounding large volumes of water that has the potential to damage infrastructure and flood surrounding areas as depicted here.

### [Flooding and Fluvial Erosion: History and Extent of Impact](#)

Flooding and fluvial erosion are the most common types of natural hazards that occur frequently in Vermont. During the hazard assessment exercises, flooding and erosion hazards were identified as outcomes from various weather events including **hurricanes, tropical storms, ice jams, severe thunderstorms, or heavy rain events.**

#### State and Regional Flood and Erosion History and Impact

Although **hurricanes and tropical storms** rarely impact Vermont, they have historically caused the greatest state natural disasters. Prior to Tropical Storm Irene in August of 2011, Vermont was impacted by Tropical Storm Floyd in November of 1999, causing major flooding and power outages. However, the Hurricane of 1938 may have been the most powerful tropical storm to hit Vermont in modern times, with sustained winds of 74mph which was claimed to have changed the landscape of the state with the extensive tree damage.

The Flood of 1927 termed ‘the greatest natural disaster’ was a 500-year flood event caused by a tropical system in Vermont in November with over 9 inches of rain falling on frozen ground that caused the most extensive flooding and structural damage and greatest loss of life in recorded history for the state. The Great New England Hurricane of 1938, one of the most powerful and destructive hurricanes to hit

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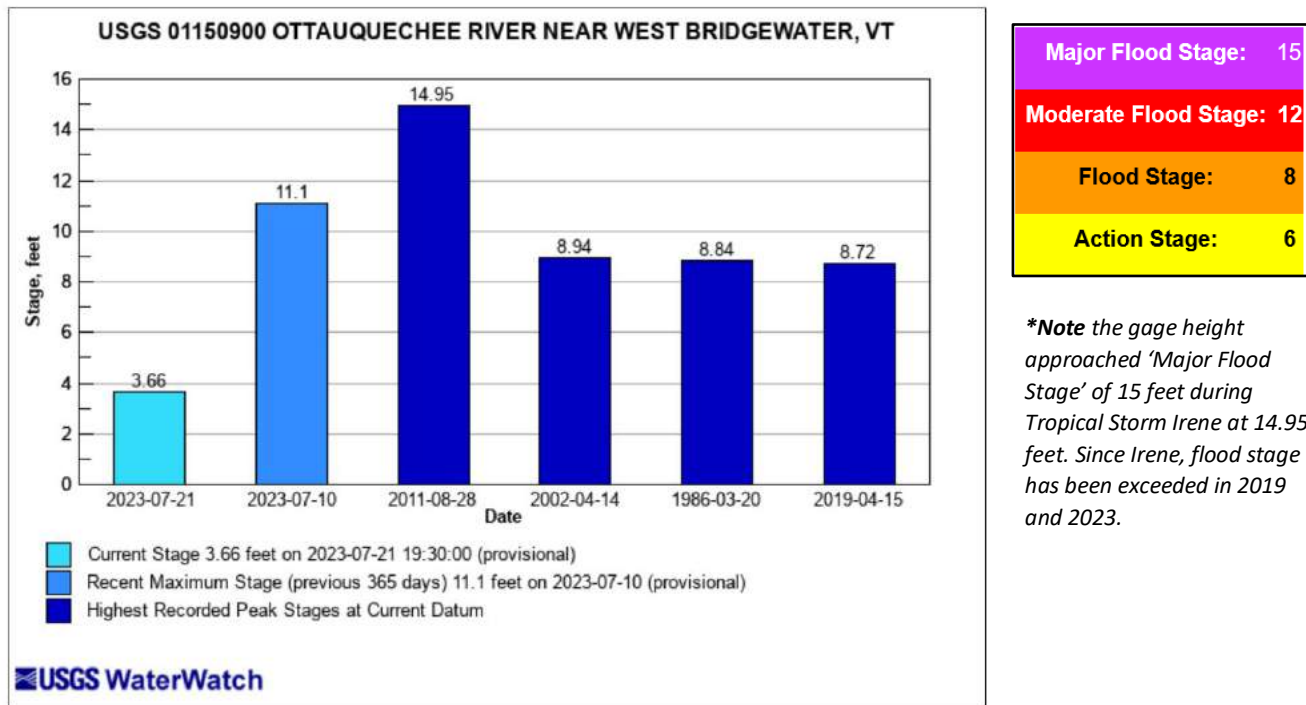
<sup>6</sup> Municipal Guide to Fluvial Erosion Hazard Mitigation, Vermont Agency of Natural Resources

southern New England and the region of Southeast Vermont with winds over 100 mph caused over \$300M in damages (\$5 billion in current dollars). In the year 2011, four regional disaster declarations were issued in Vermont due to flooding and fluvial erosion. The fourth was Tropical Storm Irene, estimated at over a 100-year flood event, occurred in late August when up to 11 inches of rain fell in some areas of the State. These significant state-wide historical flooding events and their impact on the region are detailed in **Appendix E: Vermont Historic Flood Events**. The recently declared flood disaster is still under assessment and is not yet included.

On a regional level, of the 19 FEMA Declarations for Windsor County since 1992, 16 were related to flooding, one to a winter storm and the most recent two to COVID-19. FEMA assistance for the most recent of these Declarations impacting Windsor County is shown in **Figure 5.2-2: Regional Impact of Federally Declared Disasters**. These flood damages are associated with inundation flooding and fluvial erosion; however, data indicate that greater than 75% of flood damages are associated with fluvial erosion.

The United States Geological Survey (USGS) maintains a streamgauge on the Ottauquechee River in West Bridgewater, VT which is the closest daily monitored gauge location unimpeded by instream structures and most representative of the Black River north of the North Springfield Flood Control dam. During Tropical Storm Irene, gage height approached major flood stage and moderate flood stage during the recent July 2023 event, as shown below in **Figure 5.2-1**.

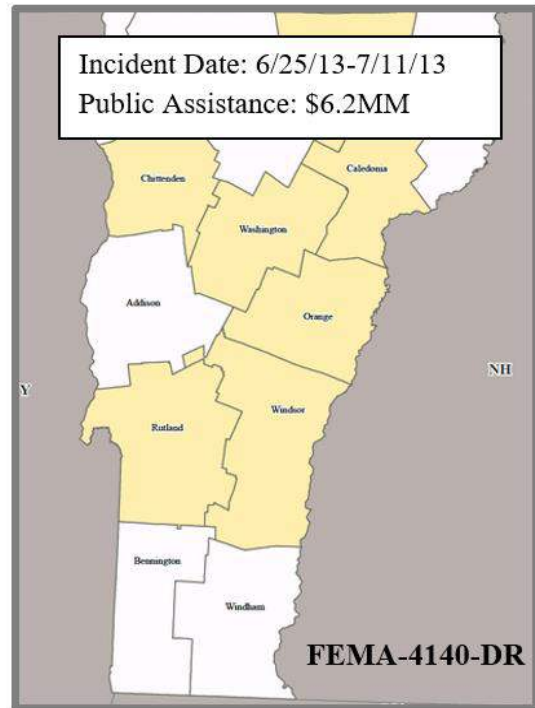
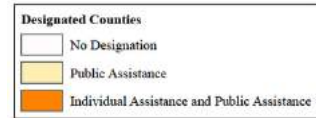
**FIGURE 5.2-1: Historical Gage Heights for Ottauquechee River near West Bridgewater, VT<sup>7</sup>**



<sup>7</sup> <http://waterwatch.usgs.gov> accessed in 7.21.2023, Toolkit, Flood-Tracking Chart

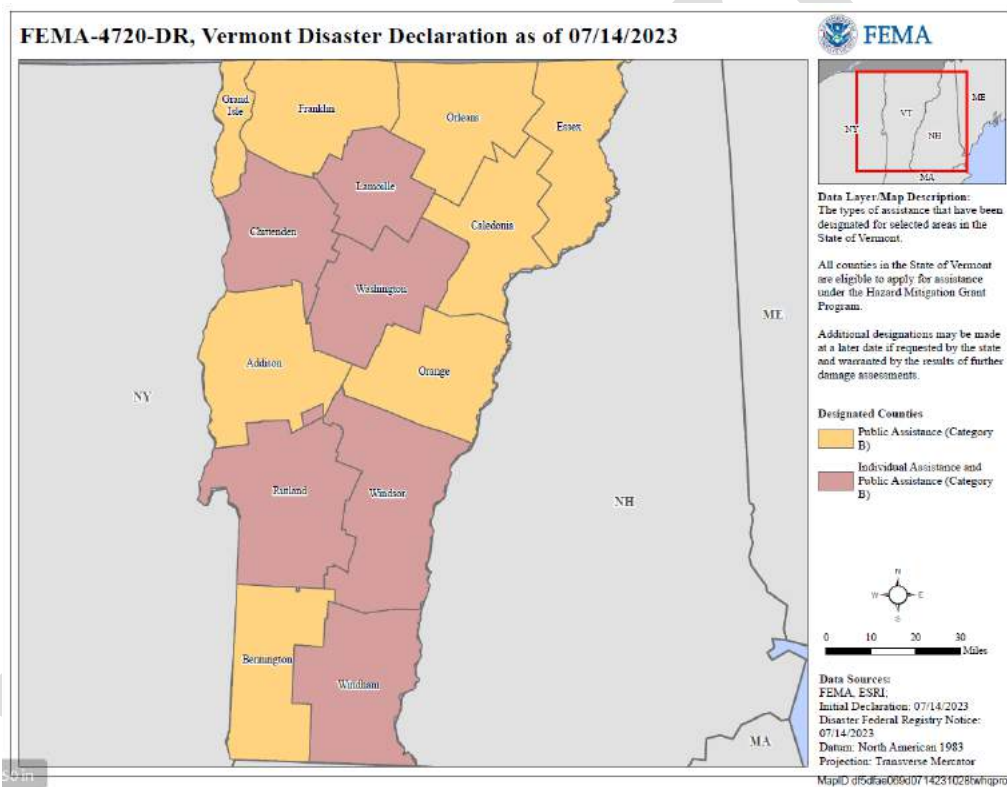


**FIGURE 5.2-2**  
**Regional Impact of**  
**FEMA Declared Disasters**  
**Severe Storms and Flooding**



**FIGURE 5.2-2 (cont.)  
Regional Impact of  
FEMA Declared Disasters  
Severe Storms and Flooding**

At the time of this plan writing, severe storms and flooding in Vermont have severely impacted several counties in Vermont prompting a Federally Declared Disaster #DR-4720-VT, announced on July 14<sup>th</sup>, 2023. Severe storms and heavy rainfall on July 7<sup>th</sup>, following weeks of prior persistent precipitation, caused catastrophic flooding, erosion, and infrastructure damage in Windsor County. The Town of Cavendish and neighboring Ludlow were the hardest hit in the County. Damage has not yet been assessed.



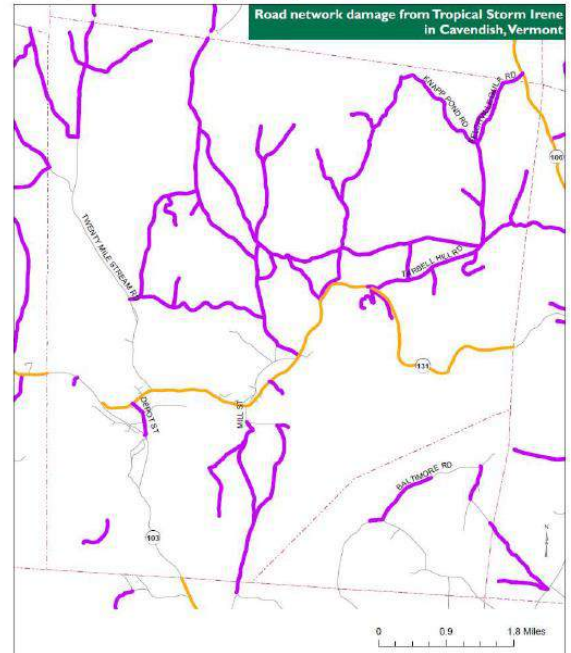
**Local Flood and Erosion History and Impact**

In 1927, the largest flood on record in Vermont destroyed much of lower Cavendish Village and many houses and barns. Long sections of road and buildings were washed away due to a quarter mile channel avulsion bypassing the Cavendish Gorge.

The Cavendish community has experienced four major floods within the last 50 years. In June of 1973 up to 6 inches of rain fell and washed out mainly roads and bridges and damaged the waste water treatment

facility which has since been relocated. This was followed by Tropical Storm Floyd in 1999, Tropical Storm Irene in 2011, and most recently July 2023.

Damage sustained by the Town of Cavendish from Tropical Storm Irene, estimated at \$4.0 million, was due primarily to flooding and fluvial erosion. Road damage was extensive as shown in the map of Road Network Damage. Low lying parts of the villages of Proctorsville and Cavendish became inundated and damaged by devastating currents. All roads connecting Cavendish to the outside were closed and a chasm on the eastern side of Cavendish Village undermined Route 131. The flood waters inundated Proctorsville Village, causing major damage. Flood waters wiped out roads, bridges, culverts, sewer and water mains, driveways, utility poles, homes, properties, commercial buildings and churches.



Since Irene, flooding and fluvial erosion damage have occurred in limited areas of the State from intense, scattered storm events and ground saturation from persistent and excessive rainfall. Damage from more recent localized flooding events impacting region is described below. Data on the physical extent of fluvial erosion and its impact in Cavendish is not available and is difficult to quantify.

- In July 2013, two to three inches of rain fell in two hours over eastern Windsor County. This followed a record spring rainfall and resulted in flash flooding (Estimated damage: \$25k).
- In July 2014, a stationary thunderstorm developed that dropped three inches of rain an hour resulted in the region causing significant damage to transportation infrastructure, residential and commercial properties, and agricultural areas. Main access roads to dozens of homes within the watershed were severed (Estimated damage: \$1M).
- In April 2019, neighboring towns of Ludlow and Cavendish, endured a flooding event from heavy rain that had little impact on Cavendish. (Estimated damage: \$100K)



Above are photos of the more recent flooding events in Cavendish and neighboring Towns of Chester and Ludlow.

Like many other towns within Southern Windsor County, Cavendish is at risk for fluvial erosion hazard flooding events. The “Cavendish Chasm” along State Highway 131 required over a million yards of fill to repair following Irene. Erosion is exacerbated by failure of infrastructure including roads, culverts, bridges and dams. This secondary hazard as a result of flooding can be costed by the capital required to repair and replace these structures, however, these reparation costs from past fluvial erosion events are not specifically identified as separate from the flooding event that caused it. Extent data in the form of acres/feet from the most severe historical flooding event is unavailable.

In recent history, severe damage from repeated fluvial erosion flooding events in Cavendish, have widened river beds and stripped river banks bare of natural vegetation making them more susceptible to additional erosion and landslides, particularly, along the Black River mainstem. Frequent floods and erosion have flattened riverbeds with additional silt and gravel forming islands in the middle which cause the river channel to divert in new directions outside of the mapped floodplain. These river islands vegetate over time with shallow roots invasives, such as knotweed, that are then uprooted in the next high flow event and carried to block a downstream underpass or culvert causing additional flooding.

The extent of impact from flooding and erosion events is difficult to assess on a local level and, therefore, this plan relies primarily on regional and state data for these hazards.

#### Insert Photos of eroded river banks

Following a wet June in 2023, heavy rainfall in early July of up to 10 inches caused wide spread river flooding throughout the central part of the state shutting down entire communities. While statistics and damages are still being assessed as of the writing of this plan, the Town of Cavendish has documented severe damage, primarily to property owners.

According to one resident, nearly all roads were impacted and many residents had property damage, such as washed-out driveways and water in the basement. Those properties that have sustained significant damage have been reaching out for assistance while other with flooded basements have held off reporting until mold started to develop. A resident assisting in recovery had this to say:

*“Having served the same role during Irene, I can say that the damage to the town itself was less- we only lost power for less than 21 hours, and many parts didn't lose it at all, and the municipal water held. The biggest issue is for the property owners, some of whom were not impacted by Irene. The damage on Depot St. seems worse this time, though it was pretty bad before. Mold continues to be a challenge. After Irene we had seven straight days of sun. Now we're lucky if we have two days strung together without rain.*

*People are aware it's climate change for the most part, and those of us running the shelter and relief efforts are not surprised by the flooding and are concerned about the fall rains to say nothing of winter ice storms. After Irene, we formed a committee and changed the shelter location from the school to the Baptist Church. The networking of churches has provided us with a lot more resources than being in the school during Irene, so this was a good change.*



*Interestingly, there is a slowness to the rebuilding. If people had been hit hard during Irene, they do question whether it makes sense to rebuild and how to do so. Also questioned could they rebuild, only to be nailed by fall rains or winter storms. I have no answers to these questions.”*

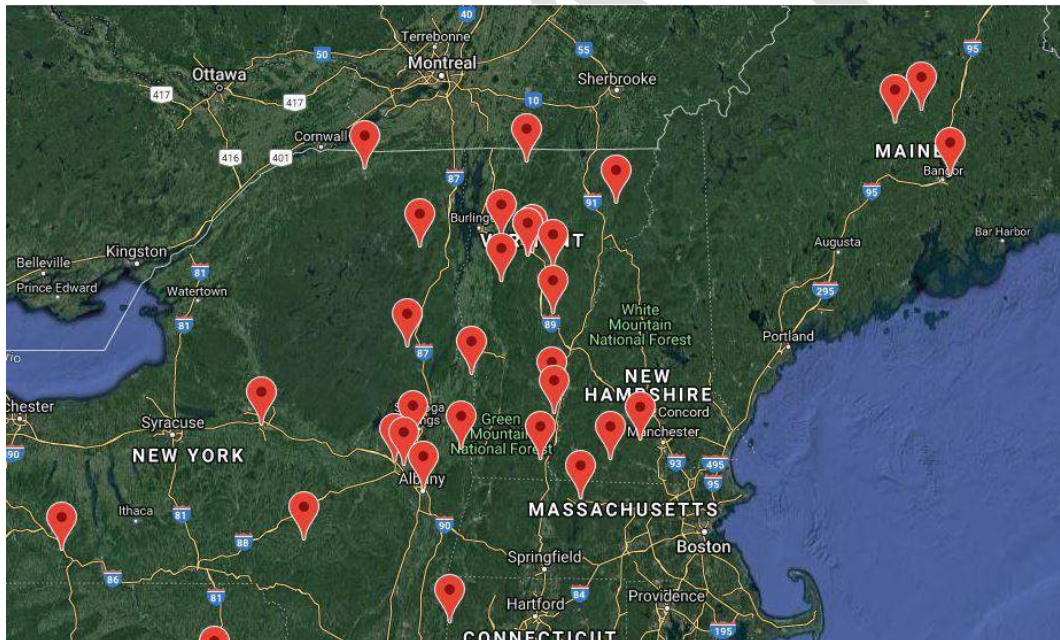


**Ice Jams** remain a threat to riverside communities like Cavendish. The most devastating winter floods have been associated with a combination of heavy rainfall, warm temperatures, and rapid snowmelt. Winter weather with less than average snowfall can result in greater ice buildup on streams and rivers, potentially resulting in greater ice jam damage.<sup>8</sup>

Vermont ranks tenth with a total of 987 ice jam events in 310 locations between 1/1/1785 and 2/26/2017, according to the Ice Jam Database State Summary Report, which is maintained by US Army Corps of Engineers' Cold Regions Research and Engineering Laboratory (CRREL). **Figure 5.2-3** below identifies the location of ice jam events in the region during 2019.<sup>9</sup> Vermont had experienced more ice jams in 2021 than any other New England state.

CRREL has recorded nine ice jams in the Black River since 1990. Many additional ice jams have occurred in town, historically, but most have not been recorded. A Federal Disaster in was declared in 1992 for Windsor County, in part, due to ice jams. Town of Cavendish occasionally experiences ice jams on the Black River following snow/ice thawing causing flooding that impacts properties along Route 131 in Cavendish Village.

**FIGURE 5.2-3 : 2019 Ice Jam Locations, CRREL Database**



<sup>8</sup> [CRREL Ice Jam Database](#)

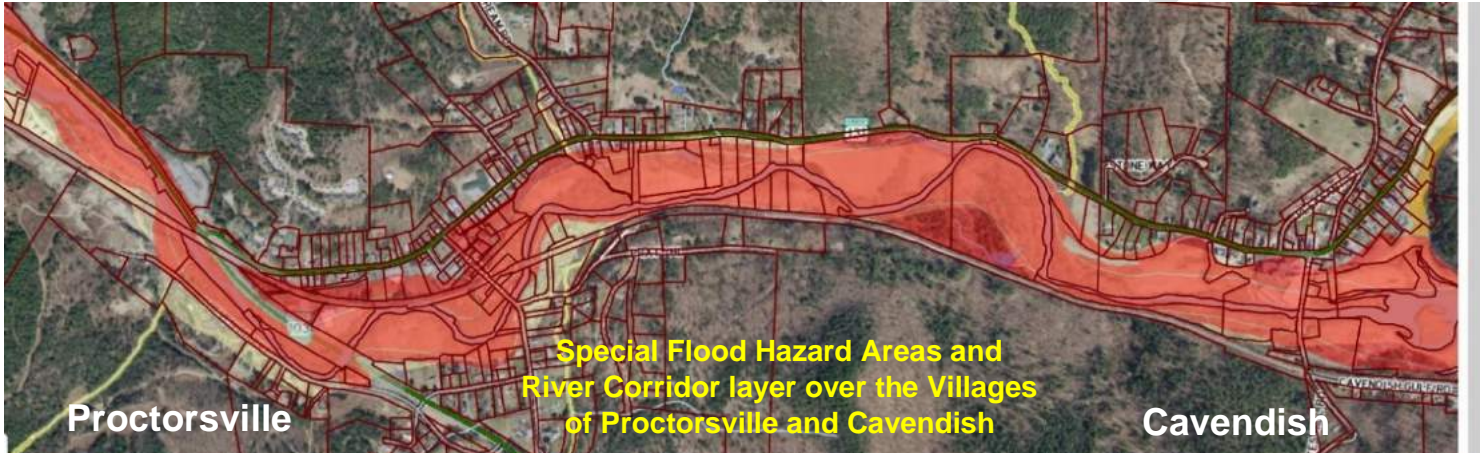
<sup>9</sup> [CRREL Ice Jam Database](#)



## Flooding and Fluvial Erosion: Trends and Vulnerability

Over the past several years, flooding has occurred in limited areas of the State from intense, scattered storm events and ground saturation from persistent and excessive rainfall. In the past 13 years, since Tropical Storm Irene, Windsor County has experienced 8 FEMA declared flooding events. The prior 19 years saw a total of 9 declared flooding events which indicates a trend of increasing frequency. In recent years, flood intensity and severity also appear to be increasing. According to prior *State of Vermont Hazard Mitigation Plans*, studies show that areas of the State can expect a greater frequency of flooding with an increase in extreme rainfall amounts.<sup>10</sup> The frequency and extent of Fluvial Erosion is also increasing given the frequency of flash and inundation flooding which leaves stream banks eroded and unable to revegetate before the next heavy rain or flood event.

Extreme changes in temperature during winter months with late winter rainstorms is also a factor causing more frequent ice jams and can be expected to increase in frequency with climate change. Flattened riverbeds also exacerbate this hazard in Cavendish.



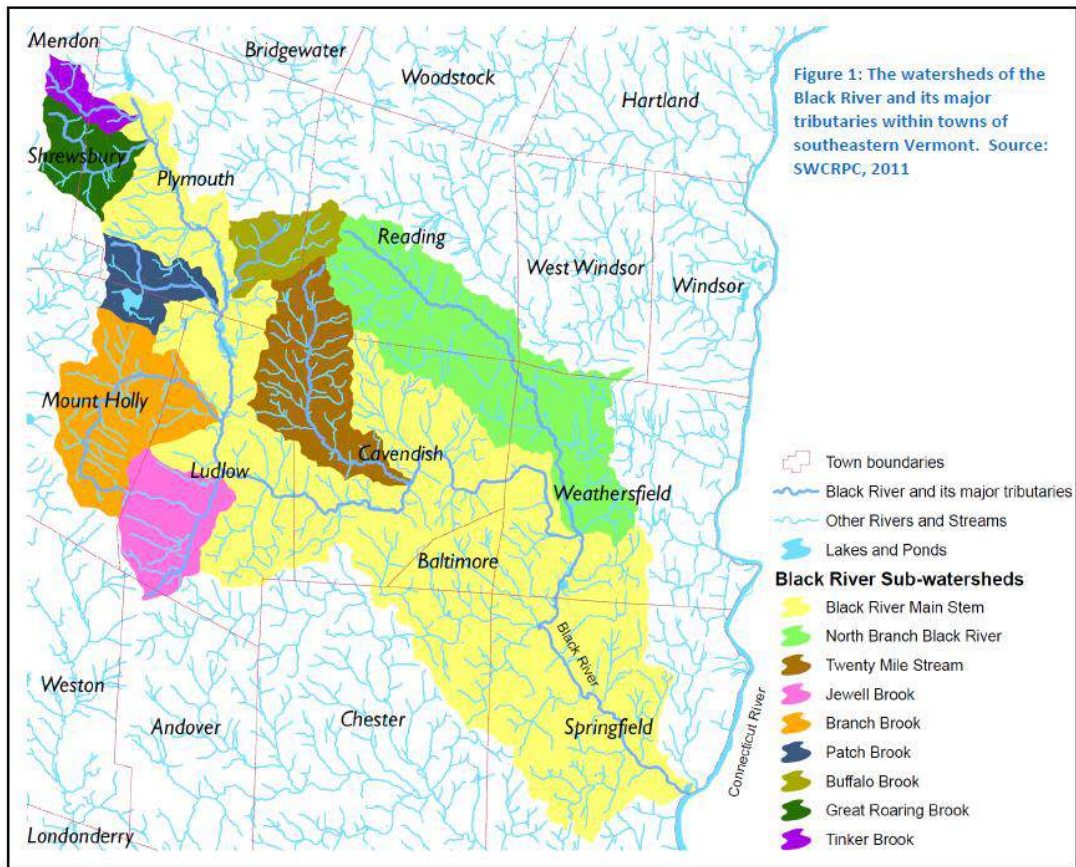
A region's **vulnerability** to flooding and erosion depends on topography, as well as meteorological events, which drains to the Connecticut River Drainage Basin. The Black River watershed corridor assessments found some of these reaches of river to be moderately to extremely sensitive to storm events

The Town of Cavendish lies almost entirely within the Ottauquechee River-Black River watershed, part of Basin 10, a sub-watershed of the Connecticut River Drainage Basin. A major tributary, Twenty-mile Stream drains to the mainstem from the north just north of the Village of Proctorsville.

Although only 6.2% of the Basin 10 land area is developed, much of this development is typically found in valleys and along waterways which is the case for Cavendish. Areas of high population concentration and services, namely the Villages of Cavendish and Proctorsville, are nestled along both banks of the Black River with sections that lie either within floodways, Special Hazard Flood Zones, river corridors, fluvial erosion hazard areas or are surrounded by floodplains (**See Appendix A: Map #2: SFHA Structures and Map #3: Water Resources**). A significant flood event in this area would disrupt evacuation routes along

<sup>10</sup> 2018 State of Vermont Hazard Mitigation Plan

Route 131, and could impact many residences, special population areas, town services, and hazardous waste storage sites (**Appendix A: Map #6: High Hazard / Vulnerable and Critical Sites**).



For the Town of Cavendish, vulnerability from a major flood event is influenced by several factors:

- Approximately, 17% of all structures in Cavendish, and 15% of all residential structures are located within a SFHA or River Corridor.
- There are 8 dams, including 5 along the Black River main stem, including the CVPS dam at Cavendish Gorge and a number of beaver dams. Proctorsville is also downstream from a high hazard dam in neighboring Ludlow.
- A number of hazardous waste sites/facilities are close to or within the flood zone including the town power plant.
- Many of the primary evacuation routes along Rt. 131 and Rt. 103 are either completely or partially within the flood zones.

**Table 5.2-4** below lists the number and types of vulnerable structures in Cavendish that lie within the Special Flood Hazard Zones (Floodway and Floodway Fringe) and the River Corridor. There are 180 structures in these high-risk areas, 66% of which are residential structures. As can be seen in the above map image, many more lie just outside these areas in the Village of Proctorsville and Cavendish.



**TABLE 5.2-4: Cavendish Structures Located within Flood Hazard Zones and River Corridor <sup>11</sup>**

Building Type	Flood Zone			Total Units at Flood Risk	Percent of Total at Risk	Percent of Total Units in Town
	Total Units in Town	Special Flood Hazard Zone	River Corridor			
# Units	# Units	# Units	# Units	%	%	
Accessory Bldg	2	1	1	2	1%	100%
Camps	71	4	10	14	8%	20%
Commercial	34	6	8	14	8%	41%
Civic/Religious	15	5	4	9	5%	60%
Mobile Home	93	7	11	18	10%	19%
Multi-Family	37	9	10	19	11%	51%
Single-Family	653	33	48	81	45%	12%
Other	145	10	13	23	13%	16%
<b>Totals</b>	<b>1050</b>	<b>75</b>	<b>105</b>	<b>180</b>	<b>100%</b>	<b>17%</b>

**National Flood Insurance Program (NFIP)**

Cavendish has been a participatory, non-sanctioned member of the National Flood Insurance Program since May 4, 1989 and regulates development in the floodplain and river corridor through the enforcement of the Town Flood Hazard Area Regulations, adopted October 17<sup>th</sup>, 2016. The regulations prohibit the following development in Special Flood Hazard Areas, River Corridors, and Setbacks. Conditional Use Review or an Administrative Permit is required for all other development.

- New residential or non-residential structures.
- Storage or junk yards.
- New fill except as necessary to elevate structures above the base flood elevation.
- Accessory structures in the floodway.
- Critical facilities are prohibited in all areas affected by mapped flood hazards.
- All development not exempted, permitted, or conditionally permitted.

The Town has in place a contract agreement with MARC staff to assist and advise the AO with project development review for compliance with Town floodplain regulations. MARC staff have received FEMA disaster training including the substantial damage assessment process with expertise in floodplain management. MARC staff will inform and assist the AO on regulating rebuilding damaged structures, improvements on existing structures, and any other proposed development in the floodplain and river corridor for compliance with the Town’s floodplain regulations.

Following an event, a MARC staffer accompanies the AO/Town Manager on site visits to damaged properties, assists in the assessments and in implementing the substantial improvement/substantial damage provisions of the Town’s FHARs. The Town is currently conducting substantial damage assessments from the recent flood event of July 2023. NFIP policies and claims are summarized in **Table 5.2-5**<sup>12</sup>.

<sup>11</sup>GIS analysis using E911 building points (2023), FEMA-mapped floodplains (2022), and ANR-mapped River Corridors (2019). Some structure locations may have changed since this data was compiled.

<sup>12</sup> [Vermont Flood Ready Community Reports for FEMA Policy & Claim Statistics for Flood Insurance](#) -Claim Information by Town, accessed 8/2/2023

**TABLE 5.2-5: Cavendish National Flood Insurance Program Statistics (Report Date 8/2/2023)**

# of Policies	# of Policies in A Zone	Total Premium	Total Coverage	# LOMCS	# of Claims Since 1978	Claims Paid Since 1978	# of Repetitive Losses
40	34	\$45,771	\$6,460,500	22	21	\$555,045	0

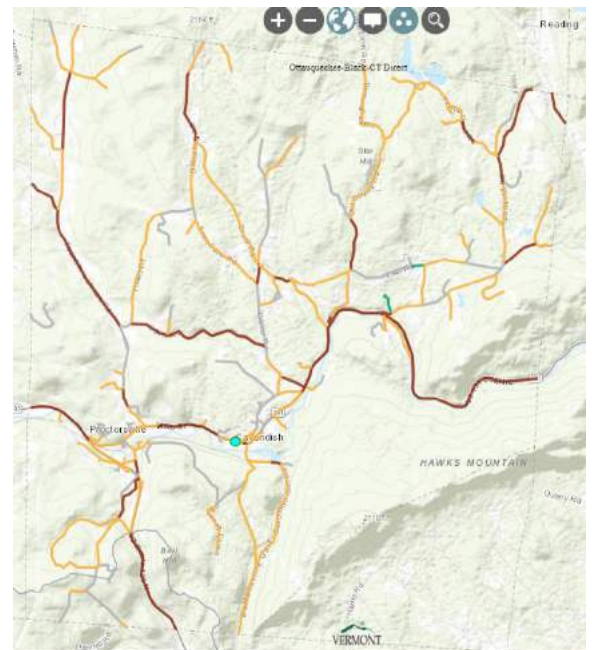
**The community areas most at risk for flooding and erosion** became apparent following Irene and more recent storm events. Although repairs made at that time have reduced the Town’s flooding and erosion risk with upgraded culverts and bridges and other best management practices to control stormwater runoff most of the impacted areas in Town remain vulnerable. Continued fluvial erosion, and the formation of new stream channels from flattening of the riverbed and blockage of flow from previous flood debris in the riverbed have created new vulnerable areas outside of the flood hazard areas.

**Bridges and culverts** are also vulnerable to flood and fluvial erosion damage, as much of this infrastructure remains undersized constricting flow or is poorly aligned. Blocked culverts compromise the structural integrity and safety of the road crossing resulting in damage to adjacent properties. [Bridge and Culvert Inventory](#) assessments are conducted every three years and provide the Town with information used to plan for infrastructure replacements and upgrades. In addition, the Black River Corridor Plan identifies culvert and bridge upgrades or removal projects for reducing flood and erosion hazard risk, as well as opportunities for increasing access to natural floodplains.

Vermont State has focused its efforts over the past four years on “hydrologically-connected” road segments as part of the **Municipal Roads General Permit (MRGP) Standards**. These standards will help to increase flood resiliency and reduce the risk of road erosion. A new road inventory, completed in 2019 based on these new standards, provides the Town with information on roads most vulnerable to erosion and is consulted in prioritizing road work each year. Cavendish has made significant progress in bringing high priority segments into compliance.

The [Vermont Transportation Resilience Planning Tool](#) (TRPT) combines river science, hydraulics and transportation planning methods and is applied at a watershed scale. The Tool identifies bridges, culverts, and road embankments that are vulnerable to damage from floods and estimates risk based on the vulnerability, and criticality of roadway segments, and identifies potential mitigation measures based on the factors driving the vulnerability. A snippet is shown here. The full map for Cavendish can be found in **Appendix A: Map #7-TRPT Map**.

Additional detail available to date on areas affected by the recent July 2023 flood can be found in **Appendix F**.



## 5.2c. Heavy Snow

Hazard Assessment Score: 3.0

## Ice

Hazard Assessment Score: 6.0

### Extreme Cold

Hazard Assessment Score: 2.5

**Heavy Snow** and **Ice** are significant natural hazard events for Vermont and Windsor County. Both have a high probability of occurrence and have the greatest impact on town infrastructure and can isolate some vulnerable residents.

**Winter storms** and **blizzards**, with **snow**, **ice**, **wind** and **extreme cold** in varying combinations, are fairly commonplace in Vermont, Windsor County and occur town wide in Cavendish. Heavy accumulation of snow can be accompanied by strong winds, cold and low wind chills. Drifting of snow from high winds cause low visibility and make it difficult to keep roads cleared. Heavy wet snows of early fall and late spring, as well as ice storms and **freezing rain**, often result in power outages and property damage, leaving people without adequate heating capability. Ice glazed roadways and sidewalks, difficult to detect, are extremely hazardous to pedestrians and motorists. Power and communication loss is often the result of downed trees from heavy wet snow or ice accumulation combined with strong wind gusts which pull down utility lines and can disrupt traffic and emergency response by making roads and driveways impassable.

Severe winter storms in the northeastern United States develop through the combination of weather and atmospheric conditions including the moisture content of the air, direction of airflow, collision of warm air masses coming up from the Gulf Coast, and cold air moving southward from the Arctic.<sup>13</sup> Winter weather related Warnings, Watches and Advisories are issued by the local National Weather Service office based on local criteria.

**A Nor'easter** is a large weather system traveling from South to North, passing along, or near the Atlantic seacoast. Cyclonic winds impact the coast and inland areas from a northeasterly direction. The sustained winds may meet or exceed hurricane force.

**Blizzards** are defined by the National Weather Service as "sustained winds or frequent gusts of 35 mph or greater (and) considerable falling and/or blowing snow reducing visibility frequently to 1/4 mile or less for a period of three hours or more<sup>14</sup>."

**Ice Storms** are defined by the National Weather Service as "occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice are considered to be of ¼" or greater."<sup>15</sup> Multiple sources state that a ¼ inch of ice accumulation from an ice storm can add 500 pounds of weight on the lines between two power lines.

**Flash Freeze** occurs when temperatures rapidly fall below freezing during precipitation with sudden severity in travel conditions. Extreme variations in topography and altitude on Vermont roadways make

<sup>13</sup> 2018 State of Vermont Hazard Mitigation Plan

<sup>14</sup> National Weather Service Glossary

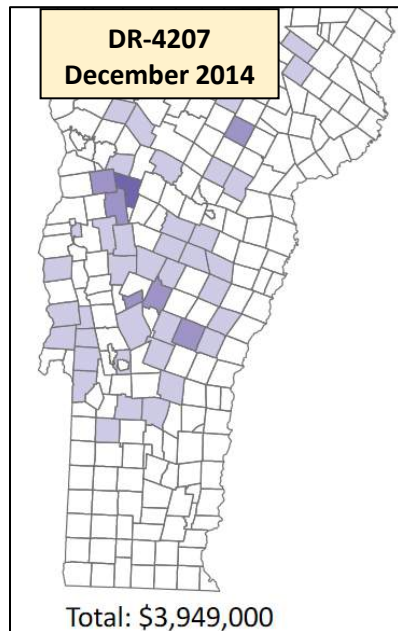
<sup>15</sup> National Weather Service Glossary

this a common hazard for motorists. Bridges and overpasses are particularly dangerous because they freeze before other surfaces.

**Black ice** is a deadly driving hazard defined as patchy ice on roadways or other transportation surfaces that cannot easily be seen. It is often clear (not white) with the black road surface visible underneath. It is most prevalent during the early morning hours, especially after snow melt on the roadways has a chance to refreeze over night when the temperature drops below freezing. Black ice can also form when roadways are slick from rain and temperatures drop below freezing overnight.

**Extreme Cold** temperatures are part of Vermont’s climate tendency to stray above or below expected temperature values. What constitutes ‘extreme cold’ can vary and is based on what a population is accustomed to in their respective climates. For Cavendish, a valley town, this hazard was assessed as having a relatively high probability of occurrence but a low potential impact.

### Heavy Snow and Ice: History and Extent of Impact



There are no standard models or methodologies for estimating loss from winter storm hazards, however, extreme winter weather is considered a way of life in Vermont and many rural Towns are accustomed and prepared for these events.

While the history of winter storm events in Vermont and the historical damaged caused is extensive, Windsor County has been a designated area in only one federally declared disaster event over the past 20 years. DR-4207 occurred over a four-day period in mid-December 2014 when heavy, wet snow and ice resulted in more than 175,000 power outages in the region, the 2nd most power outages due to weather in Vermont.<sup>16</sup> The damage assessment for Windsor County was estimated to be over \$200,000 and impacted the northwest corner of the county.

A review of [NOAA’s database](#) for Winter Storm events for Windsor County suggests that a snowfall of over 10 inches is likely to occur two to three times in a winter/early spring season. Snowfalls of over 24 inches have occurred at least once most winters but typically just in higher terrains in Cavendish. Reports of ice accumulation of 1/10<sup>th</sup> inch or more are common over the course of a winter season.

Over the past five years the NOAA has recorded 23 Winter Storm events for Windsor County, an average of four per year with most impactful events occurring in the month of March. **Table 5.2-5** below is a sampling of historical winter storm events and the extent of their impact.

<sup>16</sup> 2018 Vermont State Hazard Mitigation Plan

**TABLE 5.2-5: Notable Winter Storm Events in Windsor County, Jan/2016 – Jan/2021<sup>17</sup>**

Occurrence Date	Estimated Property Damage	Event Description
11/29/2016	\$25,000	Ice accumulation less than one tenth of an inch. Numerous vehicle accidents from icy roads. Accident between a vehicle and a tractor-trailer resulted in a fatality.
3/14/2017	\$20,000	Snowfall totals across Windsor County generally ranged from 12 to 24 inches.
3/31/2017	\$25,000	Widespread 8 to 16 inches of a heavy, wet snow across the region. Scattered power outages from the snow loading on trees and power lines.
4/1/2017	\$25,000	Widespread 8 to 16 inches of a heavy, wet snow fell across the region with scattered power outages from snow loading on trees and power lines.
12/12/2017	\$20,000	A widespread 8 to 16 inches of snow fell across the region.
3/7/2018	\$40,000	A long duration snow event dropped 12 to 26 inches across the region, with highest totals along the southern Green mountains. Scattered to numerous power outages occurred in areas of the heaviest snow fall.
3/13/2018	\$20,000	Long duration snowfall event eventually delivered 10 to 20 inches across the region. Some isolated to scattered power outages were reported.
11/26/2018	\$250,000	Light rain changed to a pasty, heavy wet snow that resulted in downed tree limbs and power outages. across VT. Snow accumulated 3 to 6 inches in the valleys but quickly rose to 12 to 20 inches above 1000 feet.
1/19/2019	\$20,000	A widespread snowfall of 10 to 18 inches occurred across the region.
3/22/2019	\$15,000	A heavy wet snow fell across the region with snowfall totals of 8 to 12 inches and higher totals in the higher elevations.
3/23/2020	\$5,000	A period of heavy snow with 2-3 inches per hour rates moved through during the evening hours with storm total snowfall of 7-10 inches. Minor, isolated power outages.
12/16/2020	\$ 20,000	Record snowfall described below
1/16/2021	\$50,000	A heavy, wet snow fell across the region with totals ranging from 3 to 5 inches in the valleys to 18 inches in the higher terrain. Numerous power outages reported.
12/25/2021	NA	Ice accumulation of up to ¼" from freezing rain caused numerous vehicle accidents resulting in the closure of portions of I89 and 25 miles of I91.
2/3/2022	\$50,000	Heavy snow and ice combination with 6-12 inches of snow followed with ¼" of ice causing numerous power outages.

<sup>17</sup> NOAA, National Centers for Environmental Information , accessed July 23, 2023



Local snow totals can vary tremendously. A recent snowfall event in December 2020 recorded snow rates of 4+ inches per hour for 6 to 8 hours across much of Windsor County. Storm total snowfall ranged from 8-12 inches in the north to 30-40 inches in the southeast upslope hilly terrain. Local reports for the December snowfall event had nearby towns of Springfield and Ludlow the hardest hit with recorded totals of 41 inches. The National Weather Service is investigating a snowfall report for this event of 44.8 inches in Peru, VT, which, if verified, will become Vermont’s highest 24-hour snowfall on record. The current state record stands at 42 inches from 1995 in Jay Peak.<sup>18</sup>



In 2021, for the Windsor County region, there were a total of seven winter weather events as listed in NOAA. Three were heavy snow events of 8-12 inches, and four were, heavy wet snow, freezing rain or sleet causing power outages which is indicative of the extreme variance in temperatures during the winter season due to climate change.

Below in Table 5.2-6 are historical data for snow and temperatures for the nearby Town of Springfield obtained from U.S. Climate Data from 2008 to 2019.<sup>19</sup> (Historical data for Springfield, VT, from 2019 to current is not available). Selected temperature data for the month of January, which is typically the coldest winter month in Vermont, is shown along with seasonal snowfalls. It can be seen that temperature trends reflect a general winter warming with the average low temperature during the month of January above the normal average low of 7°F for eight of the last eleven years. Concurrently, snow totals have tapered off as would be expected with warmer temperatures producing more sleet, freezing rain and rain during the winter season.

**TABLE 5.2-6: Winter Temperatures & Snowfall for Springfield, VT**

	January Low Temperature °F		Snow Fall (inches)				
	Lowest	Avg Low	Dec	Jan	Feb	Mar	Total
<b>2008</b>	-11	10.8	0	17	32	9	58
<b>2009</b>	-18	-0.8	28	30	12	5	75
<b>2010</b>	-4	11	19	9	23	0	51
<b>2011</b>	-20.9	7.4	14	35	30	5	84
<b>2012</b>	-11.9	14.1	0	9	2	13	25
<b>2013</b>	0	8.6	18	11	19	12	59
<b>2014</b>	-18	5.4	20	11	27	10	68

<sup>18</sup> <https://snowbrains.com/peru-vermont-record-snowfall/> (December 21, 2020)

<sup>19</sup> [US Climate Data](#), accessed July 23, 2023

<b>2015</b>	-13	1.2	7	15	31	2	55
<b>2016</b>	0	15	5	4	6	10	25
<b>2017</b>	-5	19.2	23	7	26	13	69
<b>2018</b>	-20.9	8.6	0	13	23	25	61
<b>2019</b>	-20.0	10.0	0	24	12	7	43

There is no specific region in Vermont that is more vulnerable to ice storms, according to the 2018 Vermont State Hazard Mitigation Plan. The state plan identifies accumulations for ice storms in December 2008 and January 1998 of 1/2-3/4" of ice plus 1-2" of sleet and 3" of ice, respectively. Local data for ice storms is not available. "There are no standard loss estimation models or methodologies for the winter storm hazards. Potential losses from winter storms are, in most cases, indirect and therefore difficult to quantify."<sup>20</sup>

### Heavy Snow and Ice: Trends and Vulnerability

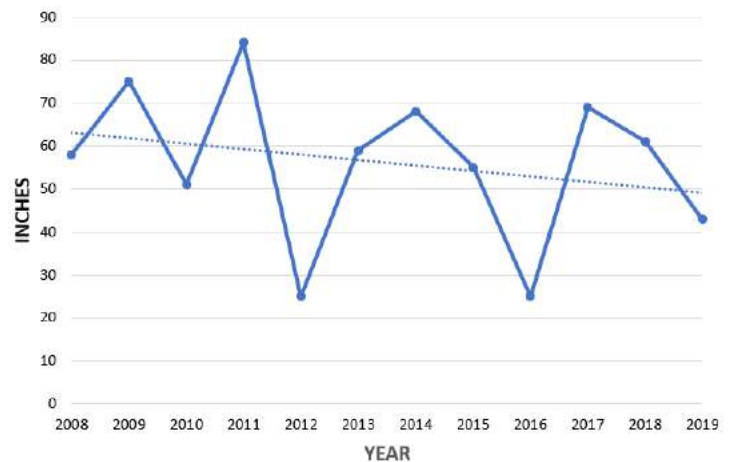
"According to the 2014 National Climate Assessment, there is an observable increase in severity of winter storm frequency and intensity since 1950. While the frequency of heavy snowstorms has increased over the past century, there has been an observed decline since 2000 and an overall decline in total seasonal snowfall."<sup>21</sup>

This is consistent with the low temperature and snow data in **Table 5.2-6** and can be visualized when a trendline is applied as shown in **Figures 5.2-4 and 5.2-5**.

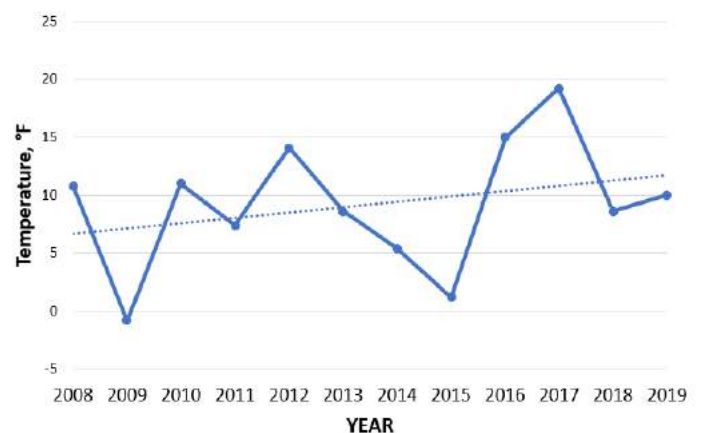
It is also worth noting in **Table 5.2-6**, that the area is seeing a greater range in temperature extremes which make for more hazardous conditions for flooding and icing. In the current year, 75-degree swings in winter temperatures ranged from -20.9 to 53.1°F in January and -2.9 to 72.1°F in February.

Data from Climate.gov's map generator, [Climate Explorer](#), compares historical to projected temperatures in the divided images below. According to this source, average daily maximum winter temperatures are projected to rise above freezing to 37°F by the 2090's for Windsor County with higher emissions compared to observed historical averages of 26°F. If emissions are lower, the maximum will

**FIGURE 5.2-4: Annual Snowfall Trend**  
ANNUAL SNOWFALL, Springfield, VT



**FIGURE 5.2-5: Annual Low Temperature**  
AVERAGE ANNUAL LOW TEMPERATURE, Springfield, VT

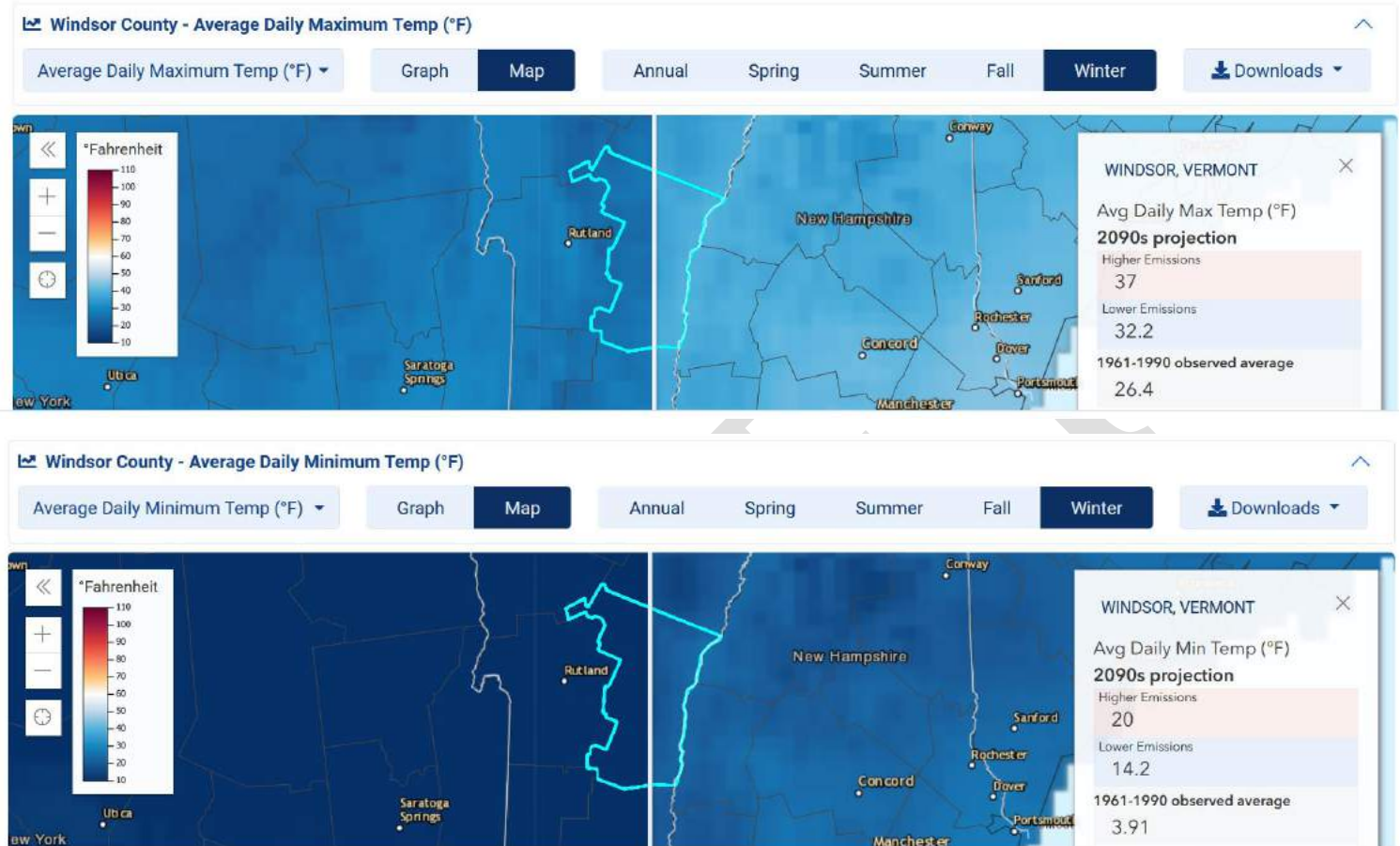


<sup>20</sup> 2018 Vermont State Hazard Mitigation Plan

<sup>21</sup> 2018 Vermont State Hazard Mitigation Plan



reach 32°F. The average daily minimums winter temperatures will also rise to 20°F over the same period compared to 4°F, observed historical averages.<sup>22</sup>



Statewide, damage from winter storms can vary depending upon wind speeds, snow or ice accumulation, storm duration, tree cover and structural conditions such as heavy snow and ice accumulation on roof tops, barns or aged structures in deteriorating condition. A roof may collapse with little or no warning, and one common misconception is that only flat roofs are susceptible to collapse. Residents can expect at least 60 pounds of weight per square foot on their infrastructure during winter months. Older residents need to be vigilant when clearing snow from walkways and driveways.



<sup>22</sup> [Climate Explorer, Climate.gov](https://www.climateexplorer.com/), accessed July 24, 2023

Vermont communities are well prepared to handle heavy snowfall. However, it is typically the secondary hazards that are most concerning to the town. Depending on the event, particularly with heavy, wet snow or ice, electricity may be down for a few hours or days due to downed powerlines from falling trees. This is a time when residents are most vulnerable to structure fire hazard or carbon monoxide poisoning. Many residents heat their homes with open flame heating sources including fireplace, wood or pellet stoves, and will supplement with electric or kerosene space heaters. Extended periods of extreme cold or loss of power during the winter months require continued vigilance on the safety of heating to reduce the risk of a structure fire as a secondary hazard.

Green Mountain Power, the utility company that currently serves Cavendish, follows a regular tree-trimming schedule. Town officials believe this can be improved to mitigate damages and power outages caused by downed trees and tree limbs during events. However, with major state thoroughfares Routes 103 and 131 also serving as a local emergency access road in Cavendish, keeping surfaces clear of snow and ice is critical to the safety of residents. Lack of sufficient sidewalks in village centers pose added risk to Cavendish residents and businesses who rely on walking during winter weather to access public services. The frequency of ice events in the region requires sufficient Town inventories of sand and salt which can be difficult when supplies are limited.

Extreme weather conditions can also lower the distribution of cellular signals from a cell tower to the receiving device. Reliability of these communications for reporting an emergency can be compromised during extreme winter weather events. This can become a greater concern as there is a trend to eliminate home landlines to save utility costs is growing.

## 5.2d. High Wind

Hazard Assessment Score: 3.75

**High Winds** can be generated from a thunderstorm, hurricane or tropical depression, a localized microburst, Nor'easter, or simply just a wind storm. Any of these events can produce wind gusts up to 50 mph or greater causing property damage and disruption in electric and telecommunication utilities, transportation, and commercial businesses. Although difficult to predict, these events also pose a high risk of injuries and loss of life but tend to be localized.

**Severe thunderstorms** are a relatively common hazard in Vermont, particularly in the spring and summer months. Although typically short in duration, they can produce damaging winds, heavy rain and flooding, dangerous lightning and large hail. Multicell cluster thunderstorms are likely to cause local flash flooding. It is the winds from these storms have most impacted the town.

The downward draft from these storms can produce **microbursts** which are not uncommon in Vermont. These events can come with wind speeds in excess of 80 mph, and pose an additional threat to low flying aircraft, making it difficult for them to maintain altitude. Although less common in Vermont, **super cell thunderstorms** are the largest, longest lasting, and most devastating thunderstorms, which can produce **tornadoes** and widespread destruction of crops and property. **Tropical storms, hurricanes, nor'easters, and winter storms** can also cause high wind damage throughout the state.

The **Beaufort Wind Scale** shown below can be used to predict damage based upon wind speeds. The National Weather Service will issue Wind Advisories when sustained winds of 31-39 mph are reached for at least one hour or gust between 46-57 mph and High Wind Warnings for winds of 58 mph or higher. Thunderstorm winds tend to affect areas of Vermont with significant tree stands as well as areas with exposed property and infrastructure and aboveground utilities.<sup>23</sup>

**Power Failure** is a common secondary hazard caused by high winds and occurs frequently within Windsor County. Power outages are most often isolated but can occur on a town-wide scale and are typically the result of power lines damaged by high winds, heavy snow or ice storms, but may also result from disruptions in the New England or national power grid as occurred in the Northeast Blackout of 2003. Dead or dying trees in proximity to power lines pose a particular threat for power failure, as these trees are often brought down by triggering events such as high winds during a thunderstorm or a Nor'easter.

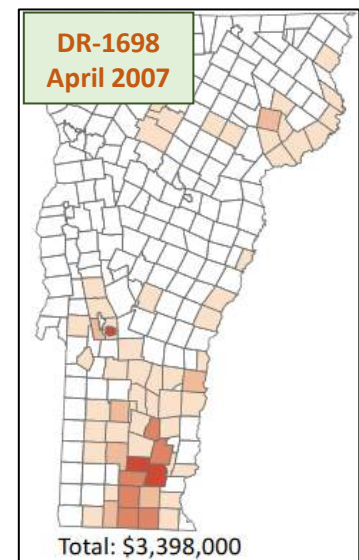
Beaufort Wind Scale		
Classification #	Wind Speed	Land Conditions
6	25 to 31 mph	Large branches in motion; whistling in telephone wires
7	32 to 38 mph	Whole trees in motion; inconvenience felt walking against wind
8 to 9	39 to 54 mph	Branches can break off trees; wind generally impedes progress; slate blows off roof; slight structural damage
10 to 11	55 to 72 mph	Damage to chimneys and TV antennas; trees broken or uprooted; considerable widespread structural damage
12 to 13	73 to 112 mph Hurricane	Peels surfaces off roofs; windows broken; mobile homes overturned; moving cars pushed off road; devastation
14 to 15	113 to 157 mph	Roofs torn off homes; cars lifted off ground; widespread devastation

\*For the purposes of the Hazard Mitigation Plan, the scale is only shown above wind force 5; Data from NOAA

### High Wind: History and Extent of Impact

Since 2000, there have been six (6) Federal Disaster Declarations for high wind events in Vermont, excluding those related to Tropical Storm Irene and Hurricane Sandy. One example of the extent of a **high wind** event in Vermont was the Nor'easter of April 2007 that resulted in a Federal Disaster Declaration, DR-1698. "High winds during this April storm resulted in many trees down and damage to some private homes and public infrastructure, primarily in Southern Vermont."<sup>24</sup> Total Public Assistance for this event was \$3,398,000 with the costliest damages in neighboring Windham County.

Since 2000, [NOAA National Centers for Environmental Information's Storm Events Database](#) recorded 30 High/Strong Wind events and 103 Thunderstorm Wind events that impacted Windsor County causing tree damage and power



<sup>23</sup> 2018 State of Vermont Hazard Mitigation Plan

<sup>24</sup> 2018 State of Vermont Hazard Mitigation Plan

outages. Three of the strong wind events were the result of Tropical Storm Irene in August 2011, Hurricane Sandy in October 2012 and remnants of Tropical Storm Isaias in August 2020. Most of the thunderstorm wind events recorded sustained winds of 40-45 mph with damaging wind gusts of 50-65 mph and isolated damage. Other High Wind events are more widespread causing power outages up to 25,000 countywide. Most of the wind reported damage is due to **thunderstorm** activity from June through September and winter storms with **heavy snow** and **ice**. Over the past 5 years from 2018-2022, the Windsor County region averaged close to 10 strong wind events a year causing, on average, \$30,000 per event.<sup>25</sup>

Reports of damage due to downed trees in Windsor County are common when wind gusts begin to exceed 40 mph. Damage is typically localized in the form of downed trees and powerlines and isolated structural damage to buildings and vehicles. The most damaging local incident in recent history occurred in July 2003. A strong storm with heavy rain, lightning and severe winds ravaged the neighboring Town of Cavendish and portions of Cavendish.

**July 21, 2003:** Classified as a tornado, the storm destroyed one mobile home (while occupied), blew apart several outbuildings, damaged several other homes in Cavendish, VT.

**Winds: > 100mph**

**Damage: \$100,000 (estimated)**

“A path of tree damage approximately 3 to 4 miles long was about 1/4 mile wide at the beginning impact point and about 3/4 mile wide at the end of the damage path. An estimated 500 to 700 trees were destroyed. Pine trees were snapped while hard wood trees were uprooted. Power lines were blown down with a number of residents without power. The actual thunderstorm winds were reported to have lasted 30 seconds or less. In the town of Reading, a number of trees were uprooted with some structural damage.”<sup>31</sup>

### High Wind: Trends and Vulnerability

Thunderstorms and associated hazards can occur anywhere in Vermont at any time of the year; however, spring and summer are the most common times for severe thunderstorms.<sup>26</sup>

The frequency of high wind events has increased. It is anticipated that extreme weather conditions, due to climate change, will continue to impact the community in the form of high winds in Windsor County. This is supported by the NOAA data which shows that of the 98 reported Thunderstorm and High Wind events since 2000, 29, or 30%, have occurred over the past 5 years. The Town has noted however that the mountains in Okemo and Ascutney provide some protection from high wind damage.

Power failures often have only minimal impact to people and property; however, longer duration events may result in major disruptions and business losses. Outages in Cavendish typically last only a few hours but can last for days if the outage is regional. The Town states that GMP is adequately responsive in making any needed repairs to bring the power back online. Potential loss estimates are difficult to predict as they are typically isolated in geographic area and short in duration. Power outages in winter months may result in the loss of home heating, ruptured water pipes, and the resulting structural damage. The loss of home

<sup>25</sup> [NOAA, National Centers for Environmental Information](#) , accessed July 23, 2023

<sup>26</sup> 2018 State of Vermont Hazard Mitigation Plan

heating may be a contributing factor to the increase in structure fires during the winter months. Local data on historical occurrences, extent of outage and associated costs are not available.

Town assets are located in developed downtown areas with less trees and are not particularly vulnerable to this hazard. The expected magnitude for future high wind events will fall between around 40 and 50 mph, or Beaufort scale number 8-9, and will likely result in downed trees, power lines, and small damage. However, the possibility does remain for larger high wind events such as the 1998 F3 tornado on the Enhanced Fujita Scale and localized microbursts.

Heavily tree-lined roads can experience frequent outages. Clearing overhanging, leaning, and dying trees near power lines is part of annual town-wide maintenance to minimize impact from high winds. Green Mountain Power has worked well with Cavendish in managing and removing trees that threaten lines utility lines.

### 5.2e. Extreme Heat

Hazard Assessment Score: 5.0

### Drought

Hazard Assessment Score: 2.5

**Extreme Heat** and prolonged hot weather and resulting **Drought** have not been of concern to Vermonters, historically. Only recently have these potential hazards captured the concern of Windsor County communities. They are profiled here for the first time in Cavendish’s hazard mitigation planning.

**Extremely high temperatures** can occur when a high-pressure system (under which air is descending toward the Earth’s surface) develops and intensifies. Under such conditions, the potential for a heat wave exists. A heat wave is a period of three or more consecutive days during which the maximum temperature meets or exceeds 90°F. Extreme hot temperatures can have significant effects on human health and commercial and agricultural businesses, as well as primary and secondary effects on infrastructure. Prolonged periods of above normal temperatures along with increases in average annual temperature, also have direct and indirect effects on other hazards such as drought, Wildland Fire, invasive species, and infectious disease.<sup>27</sup>

What is considered “extreme heat” can vary around the world and across the country. Populations in warmer climates are more accustomed to higher temperatures and have acclimated to withstand higher temperature thresholds and developed ways to cope with heat and humidity as a way of life.

The Heat Index is a measure of how hot it actually feels when relative humidity is considered in with the actual air temperature. For example, if the air temperature is 88°F and the relative humidity is 70%, it will feel like 100°F. The National Weather Service heat related advisories are shown below.

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<sup>27</sup> 2018 State of Vermont Hazard Mitigation Plan



National Weather Service Heat Advisories		
Classification	Advisory	Expected Conditions
Excessive Heat Outlook	Warning	A period of excessive heat is possible within next 3 to 5 days.
Heat Advisory	Take Action	The combination of hot temperatures and high humidity will create a situation in which heat related illnesses are possible. Heat Advisories are issued when heat indices are expected to reach at least 95°F.
Excessive Heat Watch	Warning	A prolonged period of dangerous excessive heat is possible within about 48 hrs.
Excessive Heat Warning	Take Action	A prolonged period of dangerous excessive heat is expected within about 24 hours. The combination of hot temperatures and high humidity will create a situation in which heat related illnesses are possible. Excessive Heat Warnings are issued when heat indices are expected to reach at least 105°F.

**Drought** can be defined as a shortage of water relative to need. Is a complex hazard in that it develops slowly during extended periods of low or no precipitation combined with extreme heat and high winds. It is typically widespread and can linger after normal precipitation returns. Although the surface waters may appear to have recovered from a period of drought following a return to normal precipitation, replenishing groundwater levels is a longer process.

The severity of a drought depends on the duration and extent of the water shortage, as well as the demands on the area’s water supply. Drought classification categories range from ‘D0’ for abnormally dry conditions to ‘D4’ for widespread crop devastation and water emergencies. Vermont has experienced D2 drought conditions characterized by likely crop and pasture losses, common water shortages and imposed water restrictions.

Extended periods of drought during a Vermont growing season can be devastating for state agriculture and can result in loss of potable water when wells run dry. Drought conditions are also favorable for Wildland Fires while small town fire departments that rely on river water will have limited capacity for fighting fires.

### [Extreme Heat and Drought: History and Extent of Impact](#)

The following notable **Extreme Heat events** were gleaned from the Vermont Hazard Mitigation Plan:

- Between 2000 and 2017, the number of recorded days per year with a daily temperature high greater than or equal to 85°F peaked during the 2016 summer at 45 days, closely followed by the summer of 2015 at 41 days in Burlington.
- August 2006, temperatures rose into the 90s but significantly more important were dewpoints that reached the middle to upper 70s to produce excessive heat index values of 100°F to 105°F, some of the highest values in nearly a decade.
- In July 2011, during a 4-day heat wave, temperatures across southern Vermont warmed into 90s. With dew points in the 70s combined with the hot temperatures, heat indices reached 104°F. Heat index values reached 100°F to 108°F across the Champlain and Connecticut valleys as well as some interior valleys. One death is attributed to this event in Windsor County.

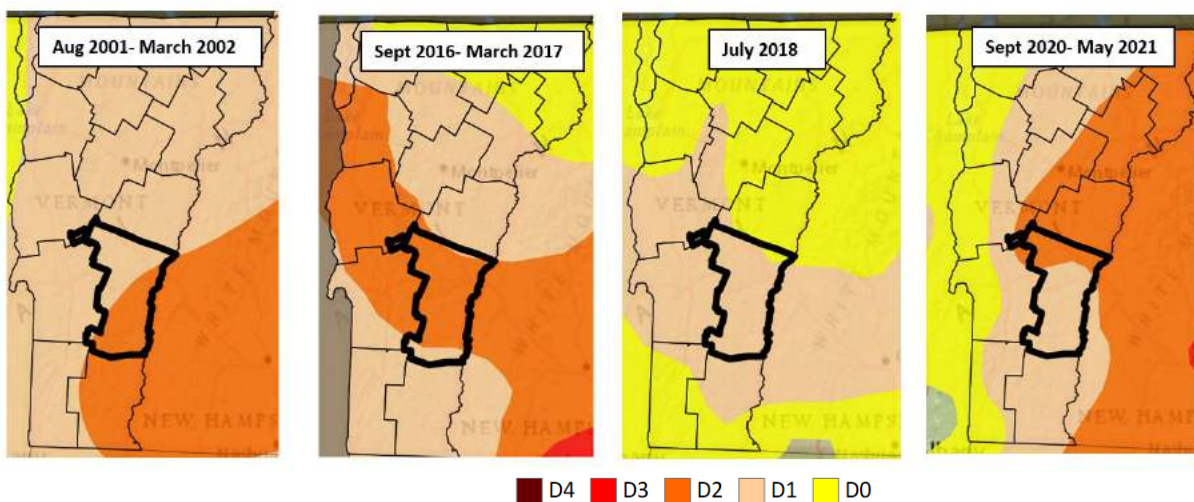
- In the summer of 2018, in Windsor County, high temperatures in the upper 80s to upper 90s with dewpoints in the 60s and 70s created dangerous heat indices in the 95-to-110-degree range between June 30th and July 5th. A substantial increase in hospitalizations occurred due to the excessive heat and duration and at least 3 deaths were contributed to the heat.
- In 2020, the 2nd longest heatwave in modern history occurred across portions VT from June 18th through June 23rd. Temperatures exceeded 90°F for up to 6 consecutive days in portions of the Champlain and Connecticut River valleys.

A review of summer temperature data from 2010 to 2019 for the Town of Springfield, suggests no identifiable warming trend during that period. In July and August, average high temperatures varied from 79 to 86°F with highest maximum summer temperatures ranging from 90 to 98°F. Three to six consecutive days of >90°F occurred in 2011, 2013, 2015, 2018 and 2019. It should also be noted that, while temperatures have exceeded 90°F each year over the past 10 years, it has exceeded that temperature for multiple days in 3 of the last 5 years.<sup>28</sup>

Vermont **Droughts** are infrequent as precipitation in the northeast is fairly reliable. According to the State plan, there were two declared statewide droughts in the summer of 1995 resulting in water usage restrictions and loss of crops in some areas. A third, more severe drought affected Southern Vermont late summer of that year.

**Figure 5.2-6** together with **Figure 5.2-9**, show regional and statewide historical occurrences since 2000 and level of drought as a percent of the State affected. Since 2000, there have been four distinct periods of Severe to Moderate Drought in Vermont. In 2001-2002, drought which began in early winter and continued through July impacting nearly 100% of the state in at least Moderate Drought (D1). In 2016-2017, a Severe Drought (D2) from October through April, affected 29% of the State with 80% in at least Moderate Drought (D1). As of the writing of this plan, Moderate Drought (D1) which began in September 2020 continues through May 2021 but has ended by July 2021. Windsor County was affected by all of these recent droughts as shown in **Figure 5.2-6** below.

**FIGURE 5.2-6: Extent of Historical Drought in Windsor County (2000 – 2021)<sup>29</sup>**



<sup>28</sup> [Current Results](#), Burlington accessed July 24, 2023

<sup>29</sup> [U.S. Drought Monitor](#)



## Extreme Heat and Drought: Trends and Vulnerability

Heat-related events are, historically, less likely to occur compared to other areas of the country. However, taking a more regional view, they are beginning to occur in much greater frequency. Both state annual minimum and maximum averages show a steady increase from 1960 (Figure 5.2-7<sup>30</sup>), with a greater rise in the minimum average rate, or winter temperatures. The **Northeast region warmed** more than any other **region** in the lower-48 over the last five decades, according to data from NOAA, and is projected to warm at a rate 50% greater than the global rate by some analysis.<sup>31</sup>

Data from [Climate Explorer](#), in Figure 5.2-8, compares historical to projected temperatures in the divided image above. According to this source, average daily maximum summer temperatures are projected to rise above 90°F by the 2090's for Windsor County with higher emissions compared to observed historical maximum averages of 78.6°F. If emissions are lower, the maximum will reach 85.9°F.<sup>32</sup>

FIGURE 5.2-7: Vermont Average Annual Temperature

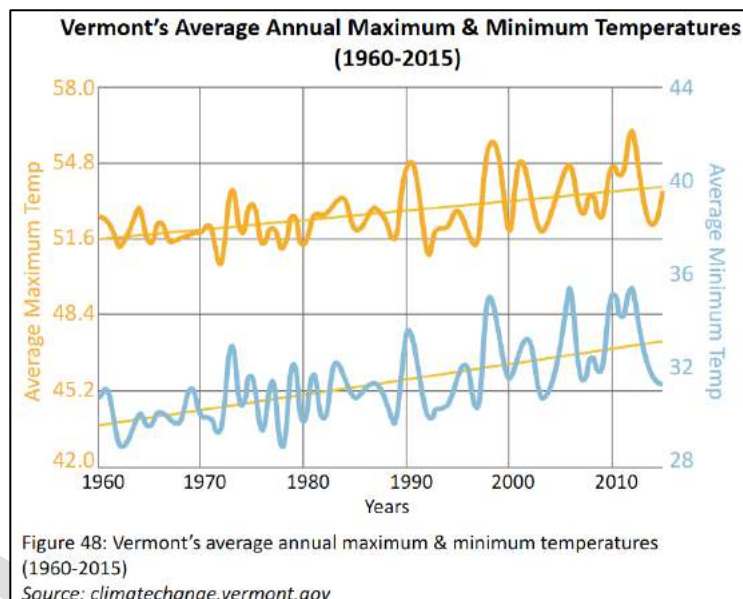
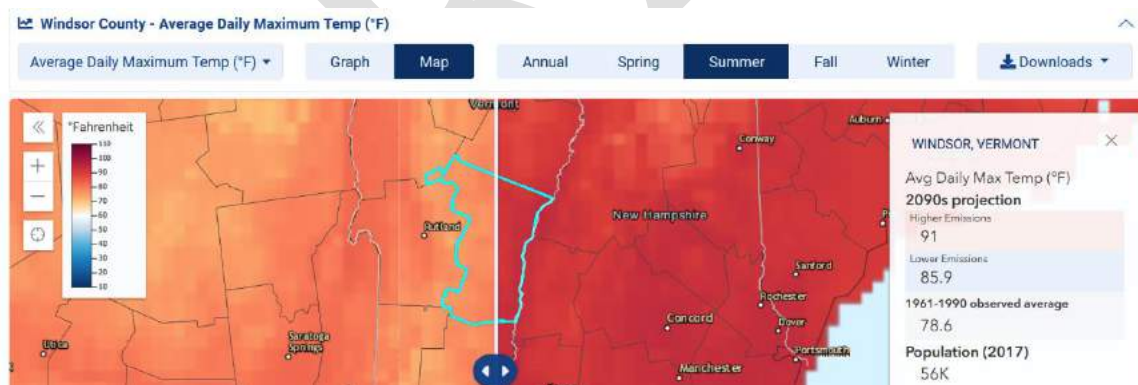


FIGURE 5.2-8: Projected Average Daily Maximum Summer Temperatures for Windsor County<sup>33</sup>



Data from [Climate Explorer](#), in Figure 5.2-8, compares historical to projected temperatures in the divided image above. According to this source, average daily maximum summer temperatures are projected to

<sup>30</sup> 2018 State of Vermont Hazard Mitigation Plan

<sup>31</sup> <https://www.usgs.gov/center-news/northeast-warming-faster-rest-us>

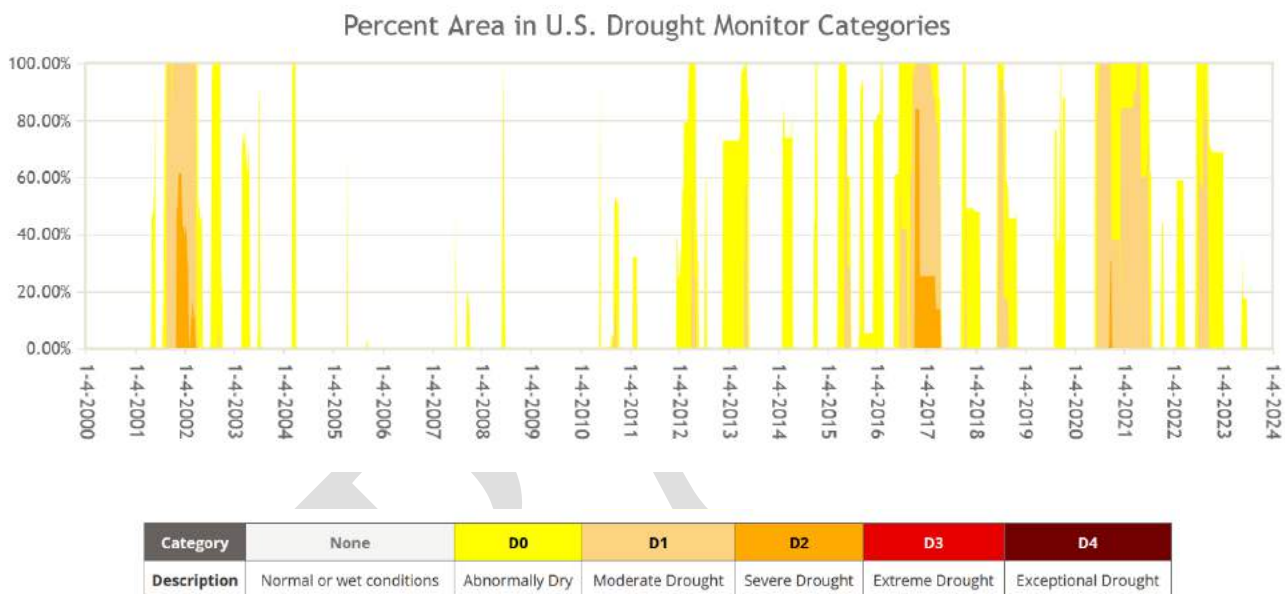
<sup>32</sup> [Climate Explorer](#), accessed July 24, 2023

<sup>33</sup> [Climate Explorer](#), accessed July 24, 2023

rise above 90°F by the 2090's for Windsor County with higher emissions compared to observed historical maximum averages of 78.6°F. If emissions are lower, the maximum will reach 85.9°F.<sup>34</sup>

Periods of drought for Vermont and Windsor County are also expected to occur with more frequency as can be surmised from the timeline below in **Figure 5.2-9** which plots the percent of area in Windsor County, VT, within the indicated drought level or category.<sup>35</sup> Over the past 20 years, since the 2002 drought, more frequent periods of D1 and D2 drought have occurred in the past six years.

**FIGURE 5.2-9: Drought Monitor for Windsor**



The primary impact of extreme heat or prolonged periods of hot weather is to human life, especially when combined with high humidity. Exposure to hot conditions can lead to heat exhaustion or heat stroke which require medical attention and can be fatal. Older adults, children, and people with chronic medical conditions, such as asthma, are at greater risk for serious heat-related illnesses. Studies by the Vermont Department of Health suggest that the heat threshold in which hospitals in the State see a rise in heat-related emergency room visits is 87°F.<sup>36</sup>

Warmer conditions also favor insect populations that cause Lyme, West Nile and Eastern equine encephalitis and other vector-borne diseases which have become more prevalent earlier in the spring and later in the fall. Much of Vermont recreational and agricultural economies rely on outdoor activities and are at greater risk of tick and mosquito borne illnesses.

Some types of cyanobacteria proliferate in warmer waters and can release natural toxins into the water. Swimming or wading in these waters can cause minor rashes and stomach problems or more serious

<sup>34</sup> [Climate Explorer](#), accessed July 24, 2023

<sup>35</sup> [US Drought Monitor](#), accessed July 24, 2023

<sup>36</sup> 2018 State of Vermont Hazard Mitigation Plan

health problems. Children and pets are at higher risk of exposure because they are more likely to play and drink water while swimming.

Critical Vermont economic sectors such as logging, farming, maple sugaring and dairy farming can be disrupted by impacts from a warming climate. Cavendish has experienced only isolated issues with extreme heat and drought but specific data is not available

DRAFT

## 6. MITIGATION PROGRAM

The following sections detail the mitigation goals and potential mitigation strategies identified by the Town and compiled and organized by the HMPT to reduce the impact of the hazards assessed in this plan. The implementation schedule that follows in **Table 6.2-1: 2021-2027 Mitigation/Preparedness Strategies and Actions** is a comprehensive list of actions that the town has targeted for implementation during the five-year cycle of this plan.

### 6.1 Public Involvement

Following the Hazard Analysis and Hazard Profile and review process as described in **Section 4**, the HMPT then agreed upon the following overarching goals and associated objectives below. Note that the numbers do not indicate goal priority but are used to identify actions that support it.

#### Hazard Mitigation Goals and Objectives

1. Provide protection and reduce risk to the community from the Impact of Hazard Events.
  - a. Implement action items that reduce the risk of potential loss of life, injuries, negative health impact, and property damage.
  - b. Implement action items the minimize financial losses due to hazard events incurred by the community including residents and business owners.
  - c. Implement action items the improve resiliency of our built and natural environment including public infrastructure, and recreational, cultural and historic assets.
  - d. Maintain, enhance and raise awareness of the Emergencies Operation Plan.
2. Raise community awareness of the Hazard Risks, Resiliency Resources and Mitigation Planning.
  - a. Encourage hazard mitigation planning to be incorporated into other municipal and community planning efforts.
  - b. Review progress on implementation of the hazard mitigation plan during publicly noticed meetings (Selectboard, Planning Commission).
  - c. Improve and enhance efforts to increase public knowledge of hazards and resources.
3. Improve effectiveness of future Hazard Mitigation Planning efforts.
  - a. Develop a process for tracking plan implementation over the plan period and incorporate phased planning for large or complex projects.
  - b. Be proactive in seeking funding opportunities for hazard mitigation projects.
  - c. Improve local engagement in reporting vulnerabilities and hazard events.

### 6.2 Hazard Mitigation/Preparedness Strategies and Actions

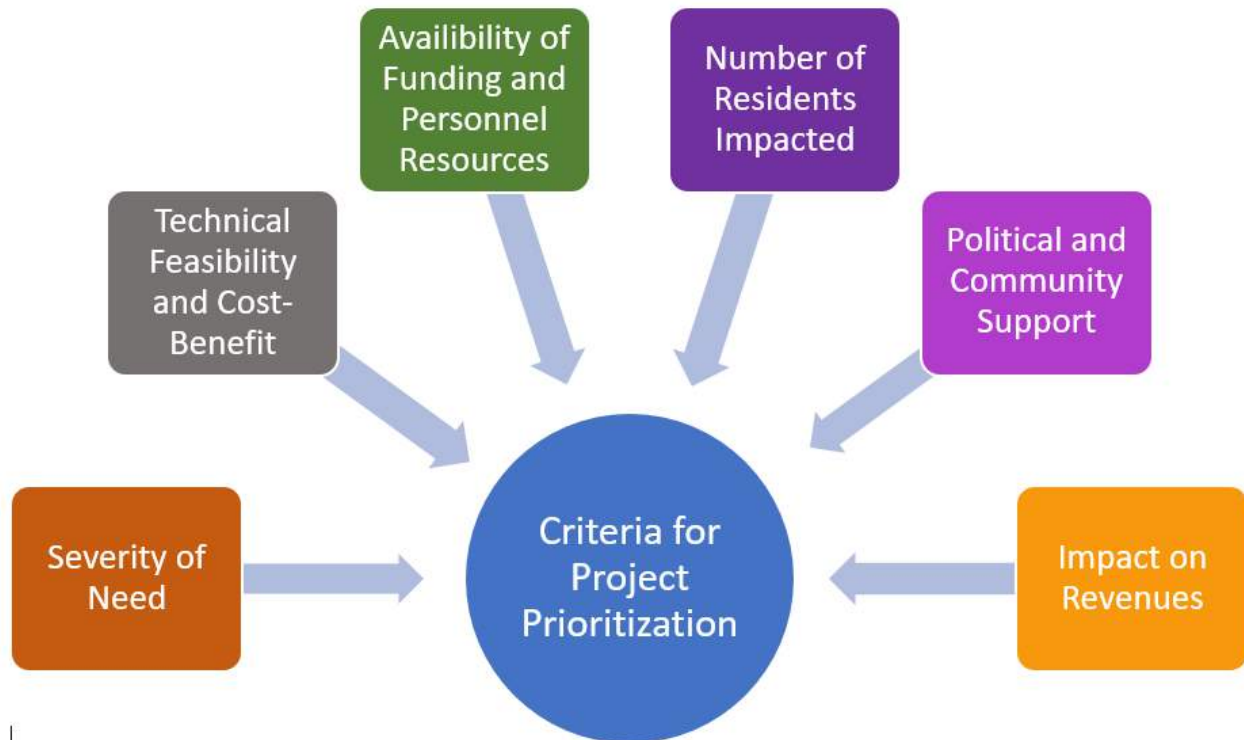
Throughout the planning process, efforts were made to identify actions that would address the Town's vulnerabilities and achieve the goals and objectives outlined above.

These mitigation actions have been chosen by the Team as the most effective and feasible actions to be taken during this plan period to lessen the impacts of the hazards identified in **Section 5**. Some of the actions from the previous plan have been carried-over or modified either because they have been expanded or because of their on-going cyclical nature. Compared to the previous Hazard Mitigation Plan, below are changes in the selection of hazards addressed and changes in the approach on formulating goals and actions:

## 6.2a Changes from Prior Plan

- The Town's **method of hazard assessment** was modified to resemble that used by the State. The hazard impact assessment was expanded to differentiate between the probability of a weather hazard event and the probability of the hazard impact which can be common to other weather events. Community impact was broken-down into four categories (life, economy, infrastructure, and environment) and assessed individually.
- **Flooding and Fluvial Erosion** have become of greater concern than in the previous plan with a current major flood event during the writing of this plan.
- **Ice** has risen in priority compared to the prior plan and **High Wind, Extreme Heat** are profiled for the first time as new hazards to be addressed. This is, in part, a result of the way these hazards are now scored, but there is also greater concern about the higher probability of occurrence of these hazards given recent and trending climate extremes in wind, temperature and precipitation events.
- Identifying **Extreme Heat** as a notable hazard is, in part, due to the growth in number of residents over 65 years of age who are most vulnerable.
- **Infectious Disease** and **Invasive Species** are new hazards to be recognized in the assessment exercises with recent experiences from the COVID Pandemic and tree infestations. Action items have been identified for these hazards.
- **More local hazard data** has been obtained and presented.
- Changes were made with the development of **specific mitigation goals and objectives** and in **methodology for prioritizing actions** to be sure they address these goals to improve plan effectiveness.
- A formalized process for **plan monitoring** was developed to improve plan effectiveness and an effort was made to better **correlate mitigation actions** to the Town Plan goals and recommendations.

## 6.2b Prioritization of Strategies and Actions



For this update, the Team selected a method for prioritization of strategies and actions based on three categories – High, Moderate, and Low compared to a more ad-hoc basis in the prior plan. It was decided that this methodology would improve overall progress on implementation with a focus on higher priority actions. Compared to a specific scoring process, this methodology for prioritization offers the following benefits:

- Provides needed flexibility as priorities can change over time.
- Allows the Town to take advantage of all funding opportunities as they arise.
- Implies that several actions can progress simultaneously.
- Works well for larger or complex phased projects.
- Encourages the Town to keep all proposed actions in mind.

To assign action priority, a number of criteria were taken together, in addition to the Hazard Analysis Score in Section 5.1, but weighted subjectively. These criteria are depicted above and listed below.

As an example, a “High” priority action would typically score higher in the Hazard Analysis and have greater weight for the first two criteria listed below than those with a “Moderate” priority.

- Severity or immediacy of need. This subjective assessment would consider the potential extent of risk in terms of structural damage repair costs, level of safety risk to residents, and probability of occurrence.
- Number of residents impacted that would benefit from mitigation.

- Availability of funding and personnel resources to implement the project. Availability of town, state or federal funds, and availability of town personnel and MARC staff.
- Strong community support and little or no political opposition or reduction in revenue.
- Project feasibility and cost-benefit. Note that Cavendish is a small town and does not currently have the capacity to determine the cost/benefit of each proposed action. However, prior to pursuing any mitigation project, the Town would consider the costs and benefits of the project using FEMA methodology.

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**TABLE 6.2-1: 2023-2028 Mitigation/Preparedness Strategies and Actions**  
**[Table to be completed at next Team Meeting]**

High Priority
Moderate Priority
Low Priority

MITIGATION ACTION OR STRATEGY (**Indicates Action is from Prior Plan)	TYPE <sup>1</sup>	HAZARD ADDRESSED	RESPONSIBLE PARTY <sup>2</sup>	TIME FRAME	FUNDING SOURCE <sup>3</sup>
<b>Carried Over from Prior Plan Review:</b>					
Permanently close off gated opening of high hazard stone culvert behind Singletons which directs water from the Black River to the Town during high flow events. *	M	Flood, Fluvial Erosion			
Consider VTculvert.org data, VT Road & Bridge Standards, Geomorphic Assessments, and Resident Input to Prioritize Culvert Replacement*	M	Flood, Fluvial Erosion			
Replace and Upgrade known undersized culverts based on above. *	M	Flood, Fluvial Erosion			
Conduct a site review of identified dam structures and determine if remedial work is needed*	M	Flood, Fluvial Erosion			
Put in place a schedule to Identify and remove high hazard trees to reduce power outages*	M	High Wind, Ice, Heavy Snow			
Public Outreach Program on Newly Adopted FHR with Focus on Awareness of Structures in River Corridor and FEH areas*	M	Flood, Fluvial Erosion			
Review Sensitive Areas Identified in River Corridor Plans for Consideration in Future Planning, Maintenance, and Mitigation*	M	Flood, Fluvial Erosion			

Identify Properties within the River Corridor or Setbacks and Provide Information on new FHAR, NFIP, and on Flood and Fluvial Erosion Hazard Risk*	M	Flood, Fluvial Erosion			
Develop a Plan to Address Citizens' Concerns Regarding Flood Risk at Impoundment Above Cavendish Gorge. Fitton Pond Restoration*	M	Flood, Fluvial Erosion			
Determine and Formalize Process for Implementing Mitigation Actions*	M	Flood, Fluvial Erosion			
<b>From Town Plan Recommendations:</b>					
Hold meetings and/or provide materials to inform property owners about these flood hazard risks and steps they can take to mitigate their risks (e.g. flood insurance, retrofit projects, property buy-outs, avoid new encroachments in harms-way).	M	Flood, Fluvial Erosion			
Purchase land along Winery Road for flood storage.	M	Flood, Fluvial Erosion			
Identify repeat flood damage properties and develop a plan to prevent and/or eliminate the potential for future damage.	M	Flood, Fluvial Erosion			
Seek grant applications for flood mitigation projects, in coordination with partners, as identified in the Phase 2 stream geomorphic assessment or Black River Corridor/Basin 10 Plans or per above.	M	Flood, Fluvial Erosion			
Encourage property owners in upland areas to utilize techniques that help to maximize on-site storm water infiltration and minimize off-site storm water flows	M	Flood, Fluvial Erosion			
Provide information to property owners within the identified flood and erosion hazard zones on what these risks involve and	M	Flood, Fluvial Erosion			

how to lessen future damages.					
Coordinate with the Black River Action Team, ANR's Watershed Coordinator, MARC and others to seek grants to protect or improve wetlands for the purpose of flood water retention.	M	Flood, Fluvial Erosion			
The Town encourages residents in these types of areas to consider taking steps, such as limiting tree cutting, minimizing site disturbances, and using special design techniques to manage stormwater on site.	M	Flood, Fluvial Erosion			
Encourage property owners to tie down all non-anchored structures.	M	Flood, Fluvial Erosion			
<b>From Town Input, Survey, MARC Recommendations and Technical Document Review</b>					
Work with MARC to Identify and map fluvial erosion hazard areas for use by Planning Commission and consideration for future regulation.	M	Flood, Fluvial Erosion			
Contract Environmental Professional services to review past Stream Geomorphic Studies of the Black River Watershed and project listed in the DEC Watershed Project Database and recommend high priority mitigation projects that will provide the greatest flood resiliency benefits to the Town.	M	Flood, Fluvial Erosion			
Determine whether local-level stormwater ordinances for development projects that fall under the thresholds for triggering Act 250 review or the States Stormwater Management rule would be beneficial reducing flood risk.	M	Flood, Fluvial Erosion			
Develop a Stormwater Master Plan.	M	Flood, Fluvial Erosion			
Annually seek funding and plan for implementation for MRGP compliance on high slope, High Priority road segments as	M	Flood, Fluvial Erosion			

identified in the MRGP road assessment inventory and experience during July 2023 flood event (See Appendix F on roads that were damaged))					
Prioritize and implement culvert upgrade replacements for recent washouts (See Appendix F for list of impacted culverts)	M	Flood, Fluvial Erosion			
Correlate Road Erosion Inventory Assessments with Transportation Resiliency Planning Tool to identify and help prioritize culvert and bridge replacement and stormwater management planning projects	M	Flood, Fluvial Erosion			
Commission advisory services from MARC to the Administrative Officer/Floodplain Officer in administering and implementing the FHAR regulations	M	Flood, Fluvial Erosion			
Initiate discussions with the State Basin Planner and with neighboring towns on coordinating development of a watershed-based mitigation plan for those within the Black River watershed.	M	Flood, Fluvial Erosion			
Develop a GIS town map with an 'erodible' soils and slope overlay for use by the Planning Commission and town permitting authorities.	M	Flood, Fluvial Erosion			
Work with MARC to develop a document repository that includes a streamline Emergency Response process and procedures (FEMA, State) as well as pertinent resources to inform town and residents.	M	Flood, Fluvial Erosion			
Contract services of an Environmental Professional to design a rebuild of Greven Recreational Filed to FEMA standards.	M	Flood, Fluvial Erosion			
Incorporate hazard mitigation into subdivision regulations, driveway access permitting.	M	Flood, Fluvial Erosion			
Contract services of an Environmental Professional to conduct a	M	Flood, Fluvial			

hydraulic study of the intersection of Rt 103 & Rt 131 where water bypasses the trestle, runs over Rt. 103 and railroad tracks flooding Proctorsville.		Erosion			
Evaluate to flood impact potential of upstream beaver dams.	M	Flood, Fluvial Erosion			
Work with State to evaluate the berming at the end of The Lane for the hydro-dam and whether mitigation to reduce flooding is plausible.	M	Flood, Fluvial Erosion			
Work with the State to determine and remove river debris at high risk for blocking underpass during flood events.	M	Flood, Fluvial Erosion			
Determine a process to initiate discussions on reducing flood risk from GMP hydro dam.	M	Flood, Fluvial Erosion			
Seek available grant funding for designing sidewalks for village centers that can be maintained for snow and ice to ensure safe walking in Town during winter months.	M	Ice, Heavy Snow			
??	M	Invasive Species			
Evaluate and install a cooling system at Town shelter to provide relief from extreme heat for those without air conditioning.	M	Extreme Heat			
Proactively reach out to GMP with identified trees that are susceptible to causing downed power lines.	M	High Wind, Ice, Heavy Snow			
Consider and incorporate, if applicable, Hazard Mitigation Actions into each section of the Town Plan goals, policies, and recommendations during the next plan update.	M	All			

<sup>1</sup> M – Mitigation, P – Preparedness

<sup>2</sup> Responsible Party: Responsible Party is shown in **Bold** and others listed are support entities

HMC – HMPT

MARC- Mount Ascutney Regional Commission

<sup>3</sup> Funding Sources:

**Town Funding**

TOB - Town Operating Budget

TCB – Town Capital Budget

**FEMA and Vermont State Department of Emergency Management (VEM)**

HMA - Hazard Mitigation Assistance Grant Program (VT State Department of Emergency Management)

HMGP – Hazard Mitigation Grant Program (acquisition, infrastructure, planning, outreach)

BRIC – Building Resilient Infrastructure and Communities Grant Program

FMA - FEMA Flood Mitigation Assistance Program

EMPG – Emergency Management Performance Grant (VT State Department of Emergency Management)

FPSG – FEMA Fire Prevention & Safety Grant

**Vermont Agency of Natural Resources (ANR)**

ERGP - Ecosystem Restoration Grant Program

DIBG – Design/Implementation (Clean Water) Block Grant Program

RCCEG – River Corridor Conservation Easement Grant (ERPG)

**Vermont Agency of Commerce and Community Development (ACCD)**

CDBG – VT ACCD Community Development Block Program

HPG – Historic Preservation Grant Programs

**Vermont Department of Fire Safety Programs (VDFS)**

**Vermont Transportation Agency (VTrans)**

MRGIA – Municipal Roads Grants-In-Aid Program

BRGP – Better Roads Grant Program



THSGP – Town Highway Structures Grant Program  
THC2RP – Town Highway Class 2 Road Program  
MHSMP – Municipal Highway Stormwater Mitigation Program  
TAP – Transportation Alternatives Program

**Conservation Programs (CP)**

VMG – Vermont Watershed Grant  
VLT – Vermont Land Trust  
CRC – Connecticut River Conservancy  
VRC – Vermont River Conservancy

**American Rescue Plan Act (ARPA)** - Coronavirus State and Local Fiscal Recovery Funds & related future funding opportunities

**MARC Brownfields Reuse Program Grants (MBRP)** – EPA Brownfields Grants through MARC

**Vermont Urban & Community Forestry (UCF)**

EABG - Emerald Ash Borer Grant Program  
CCFC-Community Caring for Canopy Grants

**Other**

VCF-Vermont Community Foundation  
VCC-Vermont Conservation Commission  
SGSG- Vermont Natural Resources Council Small Grants for Smart Growth  
New England Grass Roots Environmental Fund

## 6.3 Plan Monitoring and Maintenance Process

### Plan Monitoring Process

With the Town Manager as lead responsible party, the HMPT will be monitoring this plan as outlined below, to ensure that progress is made and identified mitigation actions are implemented as resources or opportunities become available. The Town will work with its regional partners, including MARC, to identify funding opportunities and for assistance with funding applications.

New to this plan update is an effort to formalize a method for monitoring and evaluating the Town's progress on action items and to improve local hazard data collection and public awareness and participation. The monitoring process has been identified as an action item to be implemented annually (at a minimum) over the plan period and will include a noticed annual meeting of the Hazard Mitigation Planning Team, to review and track the following:

- progress on **Mitigation/Preparedness Strategies and Actions** listed in **Table 6.2-1**;
- changes or improvements in effectiveness of **Community Capabilities and Resources** in **Table 4.3-2**;
- updates to local, regional or State hazard data occurrences and extent;
- changes in prioritization of identified hazards;
- consistency with other Town Plan goals, policies, and recommendations, and
- whether stated goals and objectives are being met

This new method for monitoring plan progress will be implemented gradually over the plan period. Once fully established, it will include an annual review to be conducted by the HMPT prior to the Town's annual budgeting process each fall with the completion of **Hazard Mitigation Plan Monitoring Form** in **Appendix G**. Monitoring forms will be completed identifying any progress made for each action and plans for the coming year. Completed forms will become part of this plan and distributed to the appropriate boards and commissions and made available for public viewing on the Town website. Following the review meeting by the Team, an update on plan progress is to be reported once each year at a scheduled Selectboard meeting which is publicly noticed with an agenda.

For these scheduled public meetings, representatives of the Planning Commission, Emergency Management, Fire and Highway Departments, and interested members of the public will be encouraged to attend. Participants will be asked during these review periods to express their concerns and experiences with natural hazards, identify new vulnerabilities and suggest additional mitigating measures. All public input during the annual plan monitoring process will be noted.

During the monitoring process, the Town will consider and incorporate appropriate hazard mitigation actions from **Table 6.2-1** as part of the budgeting process each year in the fall and as part of the planning process for updates to the Town Plan, Flood Hazard Area Regulations, Access Permits and any other related planning, as well as for future community development projects, as appropriate. The HMPT will also be responsible for ensuring proposed mitigation actions remain in line with current town goals, strategies, and policies.

## Plan Maintenance Process

The Town will apply for grant funding to update the LHMP in 2025 and reconvene the Hazard Mitigation Planning Team at the direction of the Town Manager by the 2nd quarter of 2026 to kick-off the update process and secure consultant services for assistance in the planning process. The Town Manager will again reach out to the community for additional volunteers to participate as members of the Hazard Mitigation Planning Team for the new plan period.

The Town will review the prior plan progress and monitoring forms. The Team will conduct the planning activities as outlined in the Process Flow Chart (**Appendix C**) and incorporate the plan monitoring information gathered during the annual reviews, updated hazard data, town and regional plans, and new relevant reports and studies. All public meetings will be warned following town protocols.

A preliminary draft plan will be made available for public comment on the town and regional websites, on the Cavendish Community Facebook page and hard copies will be available at the town office. A second publicly warned meeting will be held in the 3rd quarter 2027, during which any substantial revisions gathered during the public input period will be discussed. All final edits and revisions will be made, and a final draft will be provided to the Hazard Mitigation Planning Team for final review by end of 2027.

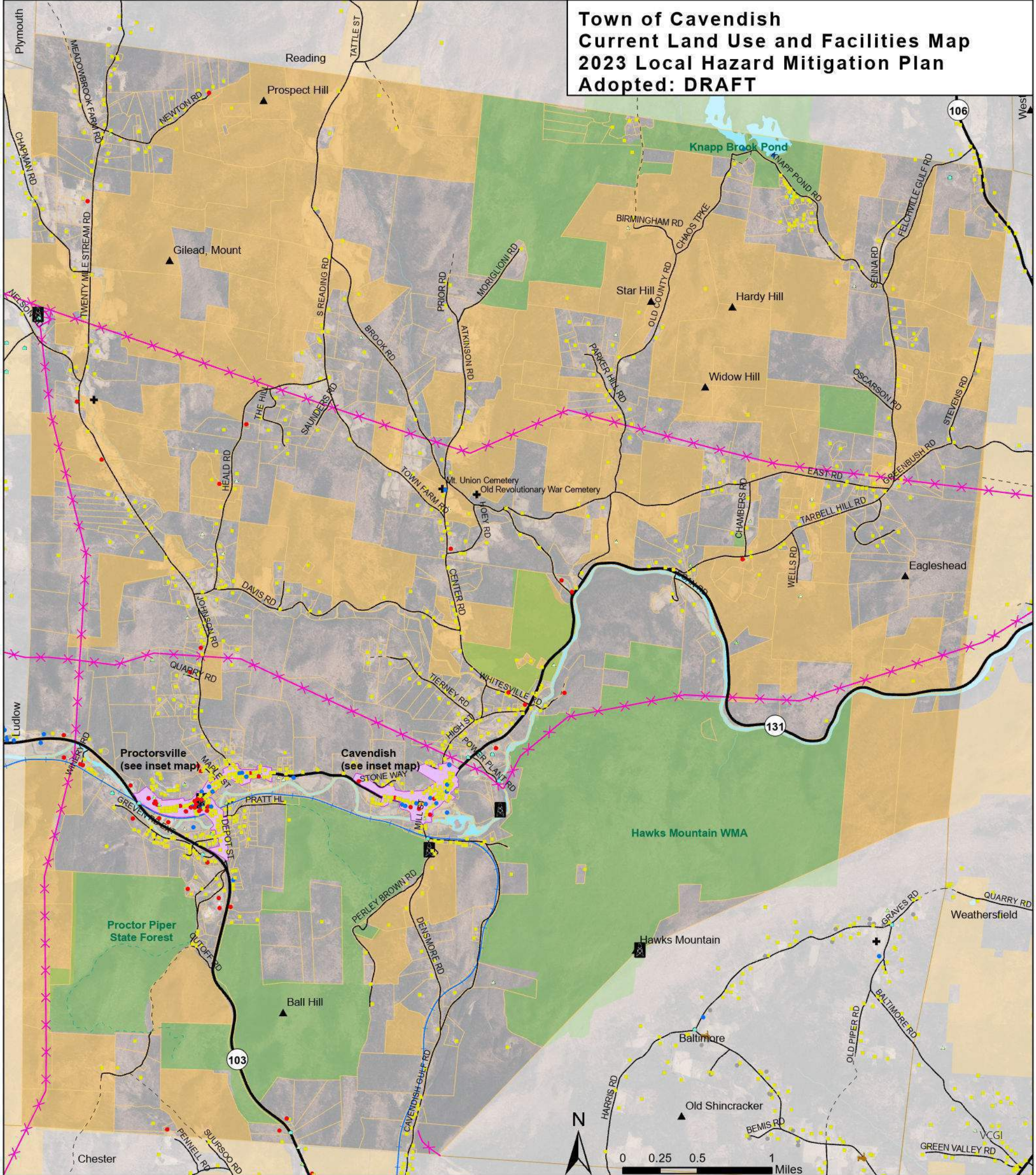
Subsequently, the plan will be sent to Vermont Emergency Management for review, approval, and referral to FEMA for Approval Pending Adoption (APA) to be completed by the 2nd quarter 2028. Following the receipt of APA, the Cavendish Town Selectboard may then adopt the updated Local Hazard Mitigation Plan and forward a copy of the adoption resolution to FEMA to complete the plan approval and adoption process before this plan expires at the end of 2028.

# **Appendix A**

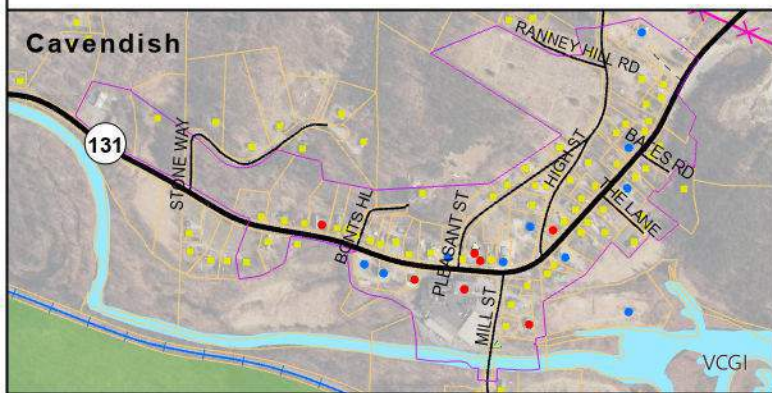
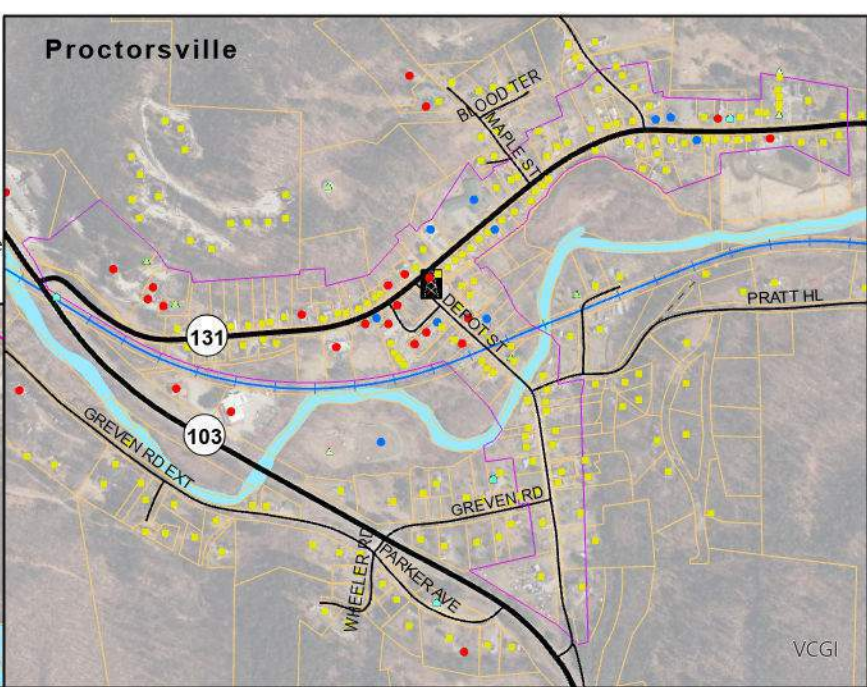
## **Maps**



# Town of Cavendish Current Land Use and Facilities Map 2023 Local Hazard Mitigation Plan Adopted: DRAFT



- ▲ Other (building)
- Government and Community
- Residential
- Commercial
- Other (non-building)
- Accessory
- Farm
- Industrial
- + Cemetery
- Telecommunications Tower
- Village Center Designation
- ▲ Hill/ Mountain Summit
- VT State Highway
- Class 1, 2 and 3 Town Highway
- Class 4 Town Hwy & Legal Trail
- Private Road
- State Forest Road
- Transmission Line
- Railroads
- Parcels (2023)
- Lakes and Ponds
- Rivers and Streams
- Conserved Lands
- Land Enrolled in Current Use
- Telecommunications Tower



Data Sources:  
Buildings (E911 2023), Cemeteries (VTrans 2001), Transmission Lines (VCGI 2003 and RPC 2013), Telecommunications Towers (Natural Resources Board 2007 and RPC 2013), Railroads (VTrans 2020), Conserved Lands (VCGI 2019), Current Use Lands (ANR 2016), Waterbodies (VHD 2019), Hill/Mountain Summit (Unknown source), Road centerline (VTrans 2023), Village Center Designation Boundary (RPC 2019), Town Boundary (VCGI 2016), Aerial Imagery (VCGI 2022), Parcels (VCGI 2023).

VT State Plane, Meters, NAD 83  
Data depicted on this map are for planning purposes only and are based on best available information. Some of the data do not line up.



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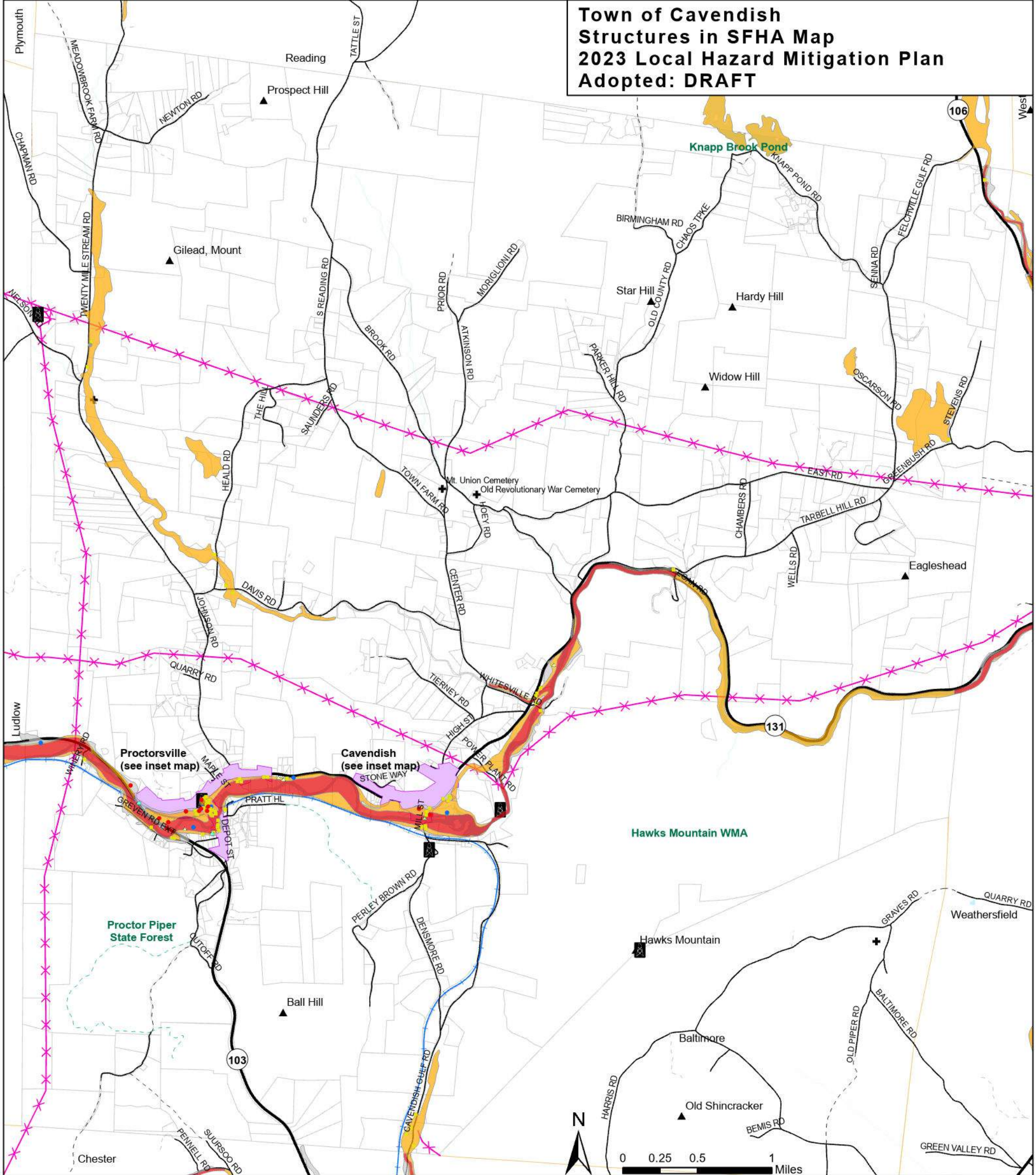
DRAFT Drawn: Aug 02, 2023



# Town of Cavendish Structures in SFHA Map

## 2023 Local Hazard Mitigation Plan

### Adopted: DRAFT



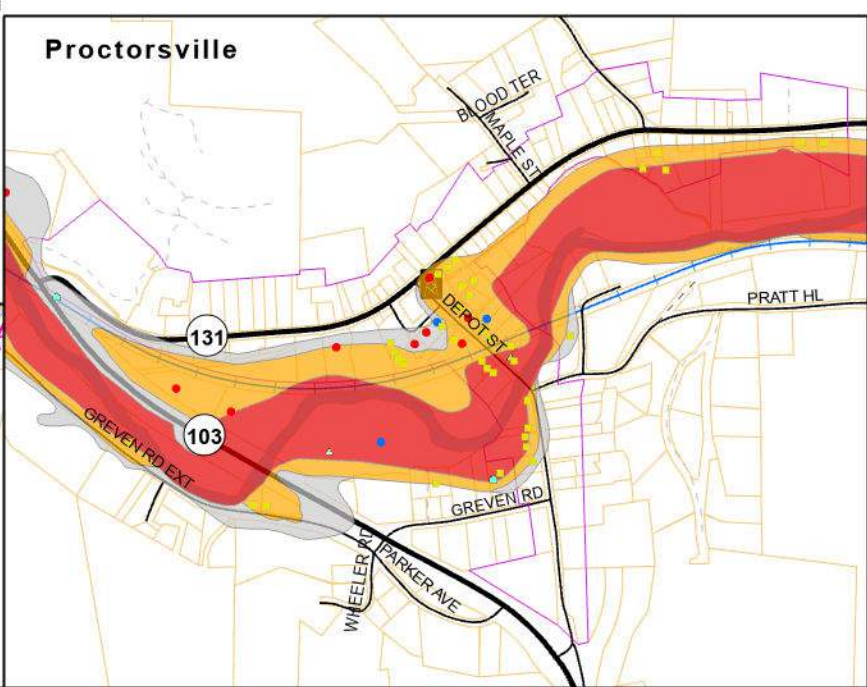
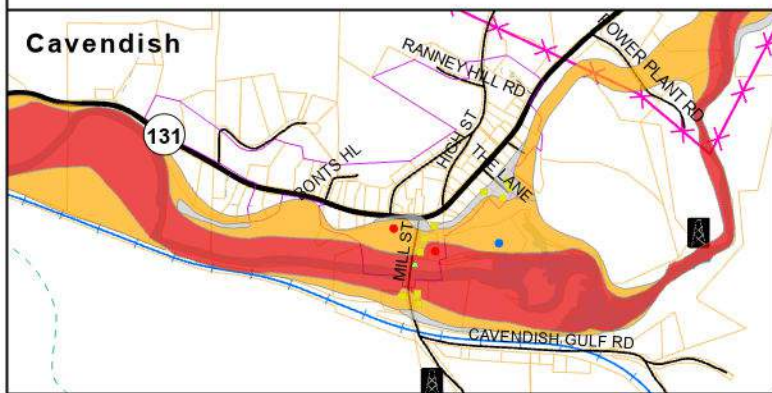
- + Cemetery
- Telecommunications Tower
- ▭ Village Center Designation
- ▲ Hill/ Mountain Summit
- VT State Highway
- Class 1, 2 and 3 Town Highway
- Class 4 Town Hwy & Legal Trail
- Private Road
- State Forest Road
- x-x- Transmission Line
- Railroads
- Parcels (2023)
- ▭ Lakes and Ponds
- Rivers and Streams

#### FEMA Special Flood Hazard Areas

- ▭ Floodway
- ▭ Zones A and AE
- ▭ 0.2 % Annual chance of flood hazard
- ▲ Other (building)
- Government and Community
- Residential
- Commercial
- Other (non-building)
- Accessory
- Farm
- Industrial

Data Sources:  
 Buildings (E911 2023), Cemeteries (VTrans 2001), Floodplain and Floodway (Special Flood Hazard Areas) (FEMA 2015), Transmission Lines (VCGI 2003 and RPC 2013), Telecommunications Towers (Natural Resources Board 2007 and RPC 2013), Railroads (VTrans 2020), Waterbodies (VHD 2019), Hill/Mountain Summit (Unknown source), Road centerline (VTrans 2023), Village Center Designation Boundary (RPC 2019), Town Boundary (VCGI 2016).

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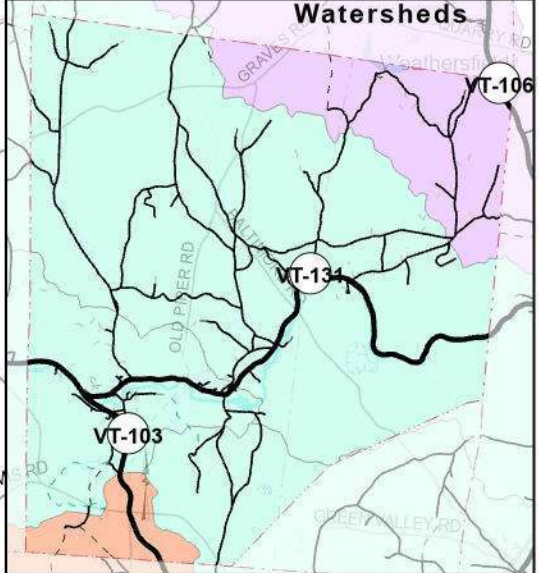
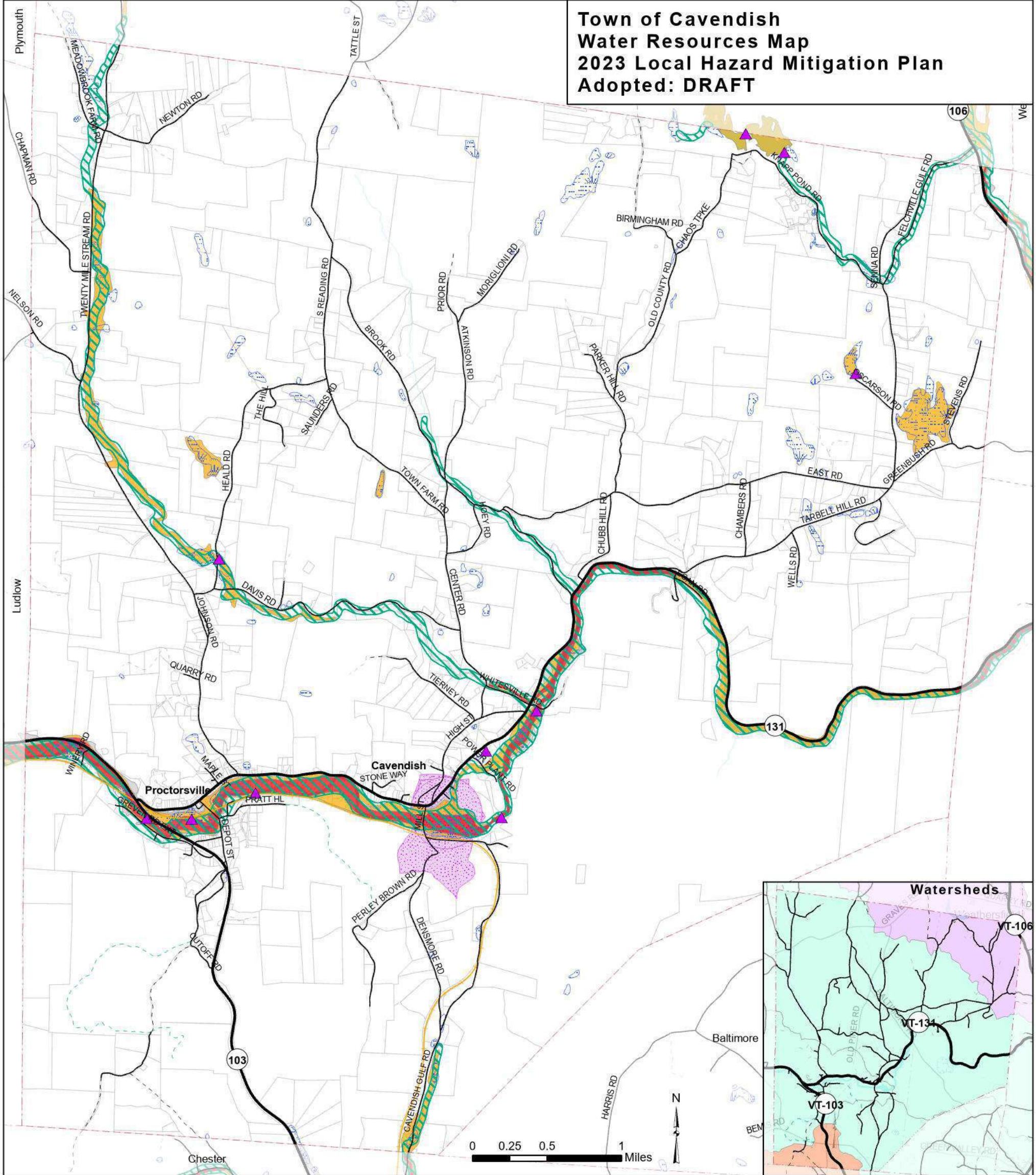
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# Town of Cavendish Water Resources Map 2023 Local Hazard Mitigation Plan Adopted: DRAFT



- Dam
- VT State Highway
- Class 1, 2 and 3 Town Highway
- Class 4 Town Hwy & Legal Trail
- Private Road
- State Forest Road
- Railroads
- River Corridor Protection area
- Wetland
- Groundwater Protection Area
- Lakes and Ponds
- Rivers and Streams
- FEMA Special Flood Hazard Areas**
  - Floodway
  - Zones A and AE
  - 0.2 % Annual chance of flood hazard
  - Parcels
- Major Watersheds (in small map only)**
  - Black River
  - North Branch Black River
  - Williams River

There are no surface water protection areas within the town.

Data Sources: Dams (ANR 2016), Floodplain and Floodway (Special Flood Hazard Areas) (FEMA 2015), River Corridor Protection Area (ANR 2019), Wetlands (ANR 2016), Groundwater Protection Area (ANR 2016), Surface Water Protection Area (ANR 2016), Railroads (VTrans 2020), Road centerline (VTrans 2023), Waterbodies (VHD 2019), Town Boundary (VCGI 2016), Parcels (VCGI 2023).

## Detailed Map



VT State Plane, Meters, NAD 83  
Data depicted on this map are for planning purposes only and are based on best available information. Some of the data do not line up.



**Mount Ascutney  
Regional Commission**

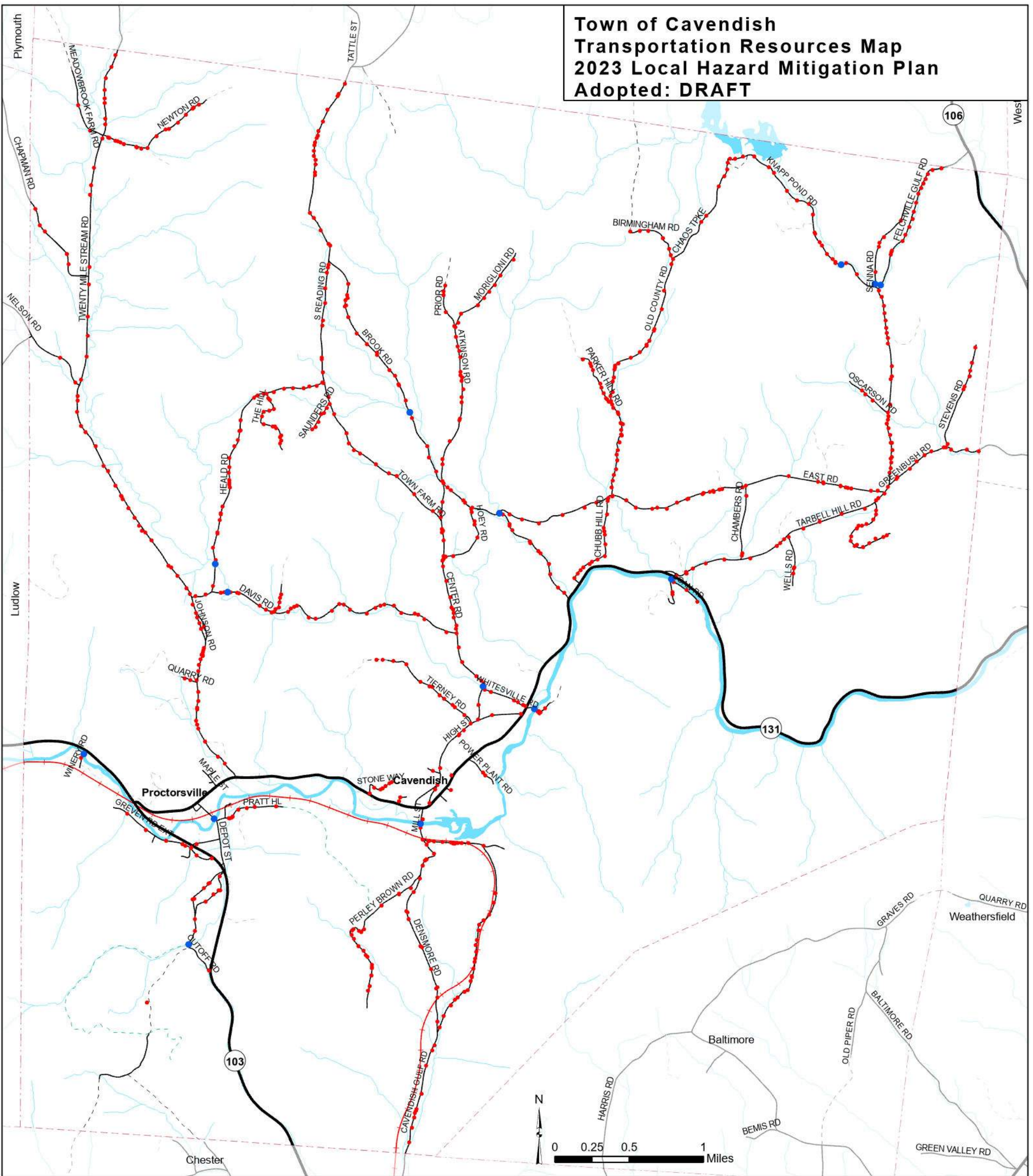
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DRAFT Drawn: Aug 02, 2023



**Town of Cavendish  
Transportation Resources Map  
2023 Local Hazard Mitigation Plan  
Adopted: DRAFT**



**Legend**

- Culverts
- Bridges
- ~ VT State Highway
- ~ Class 1, 2 and 3 Town Highway
- ~ Class 4 Town Hwy & Legal Trail
- ~ Private Road
- ~ State Forest Road
- Railroad
- Lakes and Ponds
- ~ Rivers and Streams
- Town boundary

There are no airports in Town.

Data Sources: Airports (VTrans 2016), Bridges and Culverts (VT Culverts 2023), Roads (VTrans 2023), Railroad (VTrans 2020), Water (VDH 2019), Town Boundary (RPC 2016).

*VT State Plane, Meters, NAD 83  
Data depicted on this map are for planning purposes only and are based on best available information. Some of the data do not line up.*



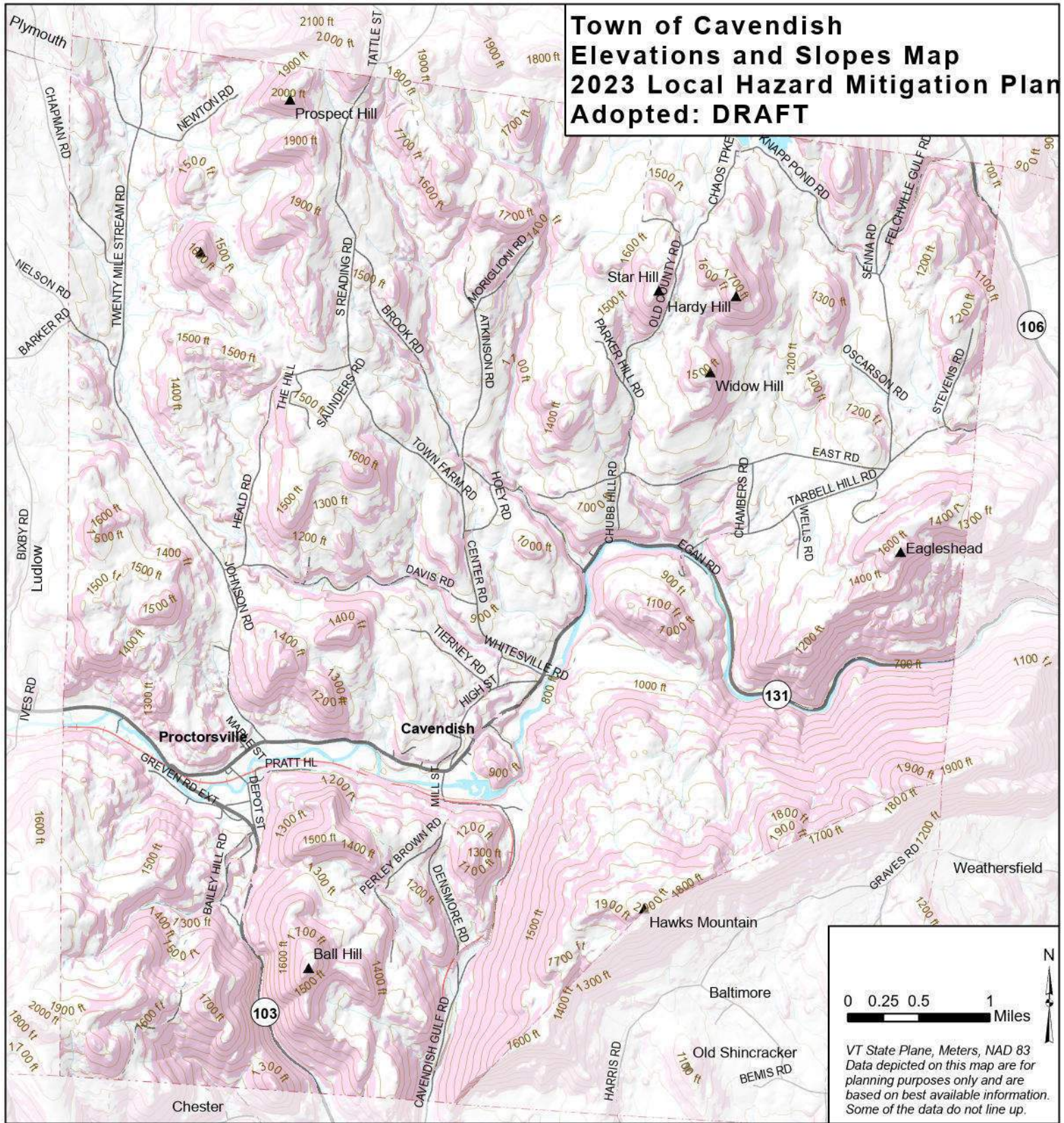
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DRAFT Drawn: Aug 02, 2023



# Town of Cavendish Elevations and Slopes Map 2023 Local Hazard Mitigation Plan Adopted: DRAFT



0 0.25 0.5 1 Miles

VT State Plane, Meters, NAD 83  
Data depicted on this map are for planning purposes only and are based on best available information. Some of the data do not line up.

- VT State Highway
- Class 1, 2 and 3 Town Highway
- Class 4 Town Hwy & Legal Trail
- Private Road
- State Forest Road
- Hill/ Mountain Summit
- 100ft Contour Line
- Steep slope of 24% or above
- Railroads
- Town boundary
- Lakes and Ponds
- Rivers and Streams

Data Sources: Contours, steep slopes and hillshade (derived from 10m Digital Elevation Model, US Geological Survey/ VT Center for Geographic Information 2012), Hill/Mountain Summit (Unknown Source), Roads (VTrans 2023), Railroad (VTrans 2020), Rivers and waterbodies (VDH 2019), Town Boundary (VCGI 2016).



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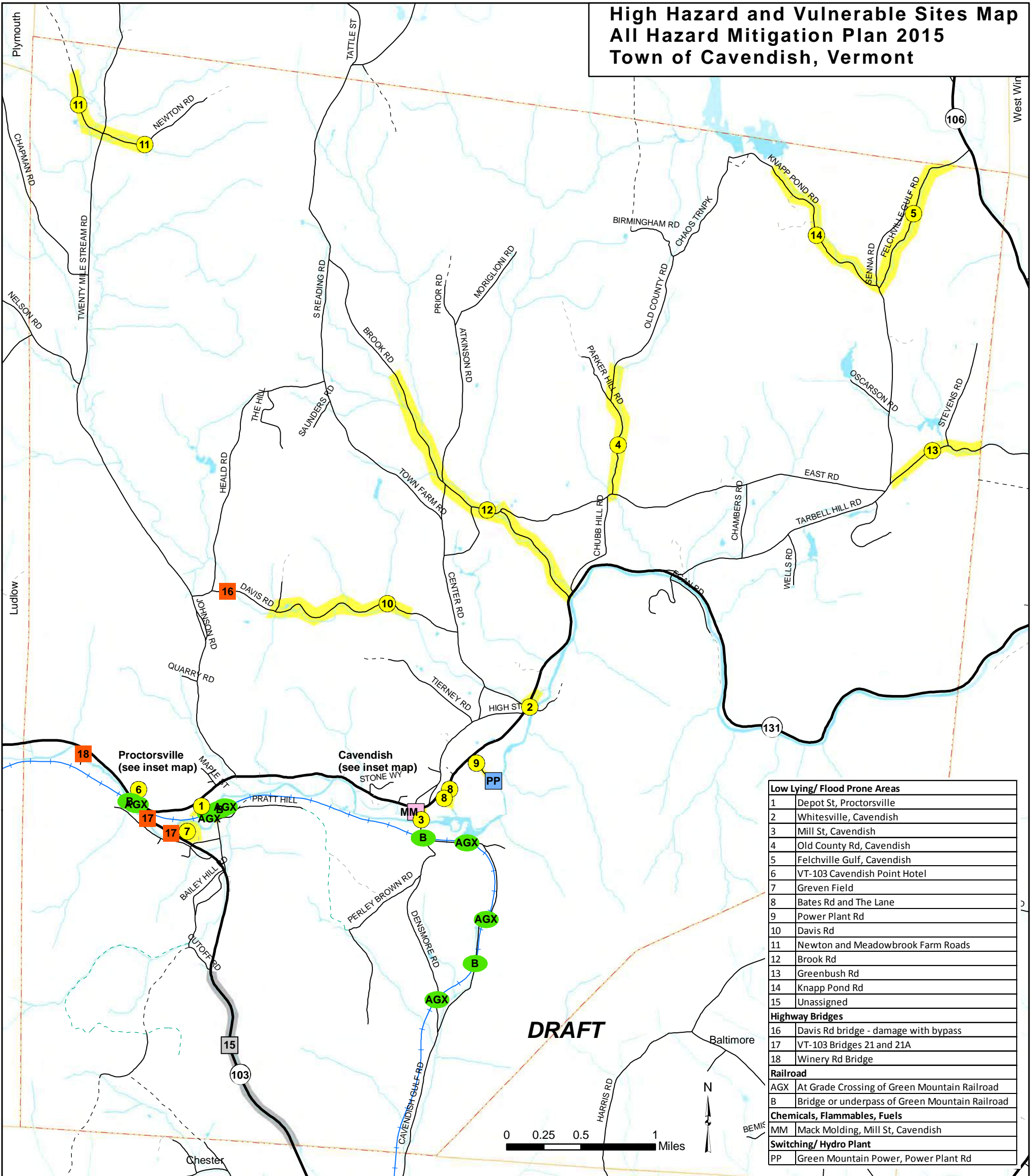
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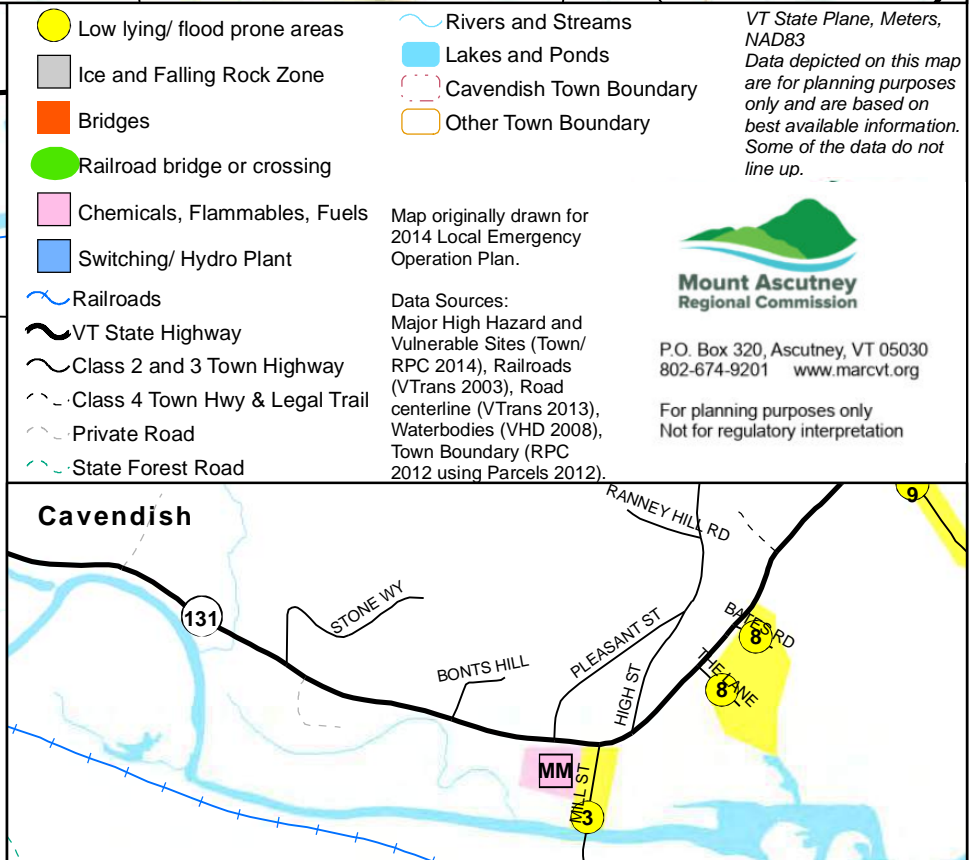
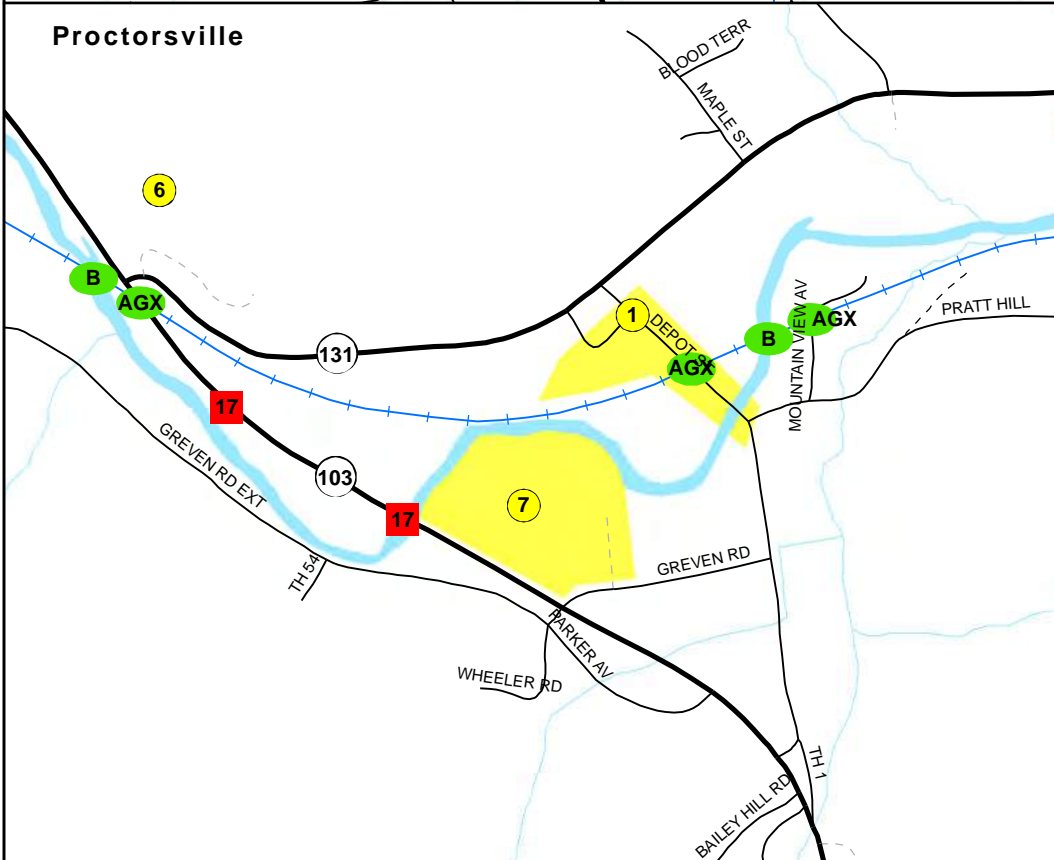
# High Hazard and Vulnerable Sites Map

## All Hazard Mitigation Plan 2015

### Town of Cavendish, Vermont



Low Lying/ Flood Prone Areas	
1	Depot St, Proctorsville
2	Whitesville, Cavendish
3	Mill St, Cavendish
4	Old County Rd, Cavendish
5	Felchville Gulf, Cavendish
6	VT-103 Cavendish Point Hotel
7	Greven Field
8	Bates Rd and The Lane
9	Power Plant Rd
10	Davis Rd
11	Newton and Meadowbrook Farm Roads
12	Brook Rd
13	Greenbush Rd
14	Knapp Pond Rd
15	Unassigned
Highway Bridges	
16	Davis Rd bridge - damage with bypass
17	VT-103 Bridges 21 and 21A
18	Winery Rd Bridge
Railroad	
AGX	At Grade Crossing of Green Mountain Railroad
B	Bridge or underpass of Green Mountain Railroad
Chemicals, Flammables, Fuels	
MM	Mack Molding, Mill St, Cavendish
Switching/ Hydro Plant	
PP	Green Mountain Power, Power Plant Rd



- Low lying/ flood prone areas
- Ice and Falling Rock Zone
- Bridges
- Railroad bridge or crossing
- Chemicals, Flammables, Fuels
- Switching/ Hydro Plant
- Railroads
- VT State Highway
- ~ Class 2 and 3 Town Highway
- - - Class 4 Town Hwy & Legal Trail
- - - Private Road
- - - State Forest Road
- Rivers and Streams
- Lakes and Ponds
- Cavendish Town Boundary
- Other Town Boundary

VT State Plane, Meters, NAD83  
Data depicted on this map are for planning purposes only and are based on best available information. Some of the data do not line up.

Map originally drawn for 2014 Local Emergency Operation Plan.

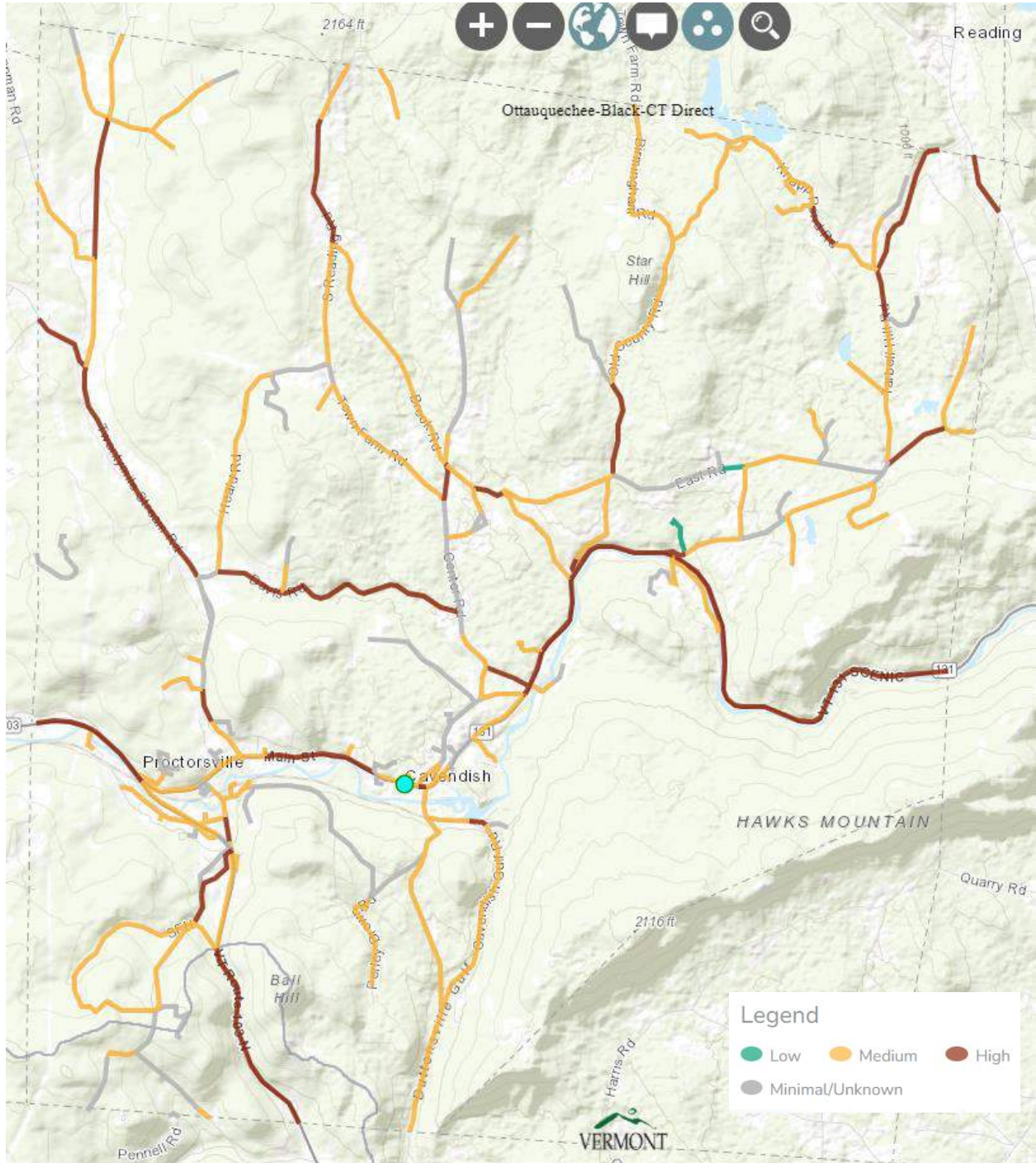
Data Sources:  
Major High Hazard and Vulnerable Sites (Town/ RPC 2014), Railroads (VTrans 2003), Road centerline (VTrans 2013), Waterbodies (VHD 2008), Town Boundary (RPC 2012 using Parcels 2012).

**Mount Ascutney Regional Commission**  
P.O. Box 320, Ascutney, VT 05030  
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Town of Cavendish  
Vermont Transportation Resilience Planning Tool (TRPT)  
8-2-2023



## **Appendix B**

### **Public Involvement Documents**



**Town of Cavendish  
Notice of Public Information Meeting**

**LOCAL HAZARD MITIGATION PLAN UPDATE  
Cavendish Town Office  
Monday, July 31, 2023  
6:00pm to 8:00pm**

**Concerned about the impact of Climate Change and Natural Disasters in Cavendish?  
Voice your concerns during the Local Hazard Mitigation Plan update.**

The Town of Cavendish is updating its Local Hazard Mitigation Plan. The purpose of this planning effort is to protect life, property, economy, quality of life, and environment of the Cavendish Community from naturally occurring hazards and disasters. We are requesting input from the local community regarding experiences and concerns about weather related events and the potential risks and vulnerabilities to hazards, such as flooding, erosion, extreme temperatures, winter storms and drought.

The Town will be holding a public meeting at the Cavendish Town Office at 37 High Street, Cavendish, VT, on Monday, July 31, 2023, from 6:00pm to 8:00pm. The meeting will be conducted by the Mount Ascutney Regional Commission (MARC). The public is encouraged to attend and share their thoughts.

If you are interested but unable to attend you can participate and provide input in other ways::

- You can participate via a virtual ZOOM link below:

<https://us02web.zoom.us/j/84990683762>

- You can find meeting agenda; planning materials and fillable templates [HERE](#)
- You can complete this brief [Climate Change in Cavendish survey](#)
- You can always provide your concerns, comments, and questions regarding this planning effort via email to Cindy Ingersoll at [cingersoll@marcvt.org](mailto:cingersoll@marcvt.org).

**Town of Cavendish  
LOCAL HAZARD MITIGATION PLAN UPDATE  
Public Meeting**

**Cavendish Town Office  
37 High St., Cavendish, VT  
Monday, July 31<sup>st</sup>, 2023  
6:00pm to 8:00pm**

*A hybrid option is available via Zoom: <https://us02web.zoom.us/j/84990683762>*

**AGENDA**

1. Introductions
2. Presentation from MARC
3. Assess Impact of Natural Hazards and Prioritize
4. Status of 2016 Hazard Mitigation Plan Strategies
5. Discuss Existing Capabilities
6. Identify Vulnerable Areas and Populations
7. Identify Potential New 2023-2028 Mitigation Actions and Strategies
8. Adjournment



**Town of Cavendish  
Notice of Public Information Meeting**

**2023-2028 LOCAL HAZARD MITIGATION PLAN UPDATE  
Review of Plan Draft**

**Cavendish Town Office**

**Date:** \_\_\_\_\_

**Time:** \_\_\_\_\_

**Concerned about the impact of Climate Change and Natural Disasters in Cavendish?  
Voice your concerns during the Local Hazard Mitigation Plan Draft Review.**

The Town of Cavendish is updating its Local Hazard Mitigation Plan. The purpose of this planning effort is to protect life, property, economy, quality of life, and environment of the Cavendish Community from naturally occurring hazards and disasters.

The Town will be holding a public meeting to present and seek comment from the local and regional communities on the Town of Cavendish 2023-2028 Local Hazard Mitigation Plan Draft, which identifies natural hazards that are most impactful to the Cavendish community and includes Strategies and Actions to reduce vulnerabilities and potential risks to hazards such as flooding, erosion, extreme temperatures and winter storms. The public is encouraged to attend and share their thoughts as the effectiveness of this planning effort relies on local engagement.

The Mount Ascutney Regional Commission (MARC), will be presenting the draft and taking comments and questions. A copy of the DRAFT Local Hazard Mitigation Plan can be found [HERE](#) or on the Town website.

A copy of the

If you are interested but unable to attend you can participate and provide input in other ways:

- You can participate via a virtual ZOOM link: \_\_\_\_\_
- You can find meeting agenda; planning materials and fillable templates [HERE](#)
- You can complete this brief [Climate Change in Cavendish survey](#)
- You can always provide your concerns, comments, and questions regarding this planning effort via email to Cindy Ingersoll at [cingersoll@marcvt.org](mailto:cingersoll@marcvt.org).

[A first draft was released for public review as follows]

- An electronic copy posted on the Town and MARC websites that circulated to individual members of the Board of Selectmen and Planning Commission, requesting comments from the local boards and community.
- An electronic distribution made to adjacent towns (Baltimore, Chester, Ludlow, Plymouth, Weathersfield, and West Windsor) via email to respective Town Clerks with a request to post the draft on their websites and provide a copy to their Planning Commission and Selectboard members.
- All distributions included the following:

*"The Town of Cavendish is seeking comment on its 2023-2028 Local Hazard Mitigation Plan draft. The purpose of this planning effort is to improve Cavendish's resiliency to natural hazards through hazard assessment, recognition of vulnerable assets, and identification of mitigating actions and strategies to reduce the impact of these hazards on the community. The neighboring town communities are also invited to attend the Cavendish Selectboard meeting of \_\_\_\_\_ at \_ PM for a review of the draft plan. The meeting will also be held virtually. Please feel free to forward any questions or comments to Rick Chambers, Town Manager at [cavtm@cavendishvt.org](mailto:cavtm@cavendishvt.org) by \_\_\_\_\_, 2023. We welcome all input."*

**Town of Cavendish  
Cavendish Climate Change Survey  
Summary of Results**

[Narrative To be completed in final draft]

[Link to Cavendish Climate Change Survey](#)

[Link to Summary of Responses](#)



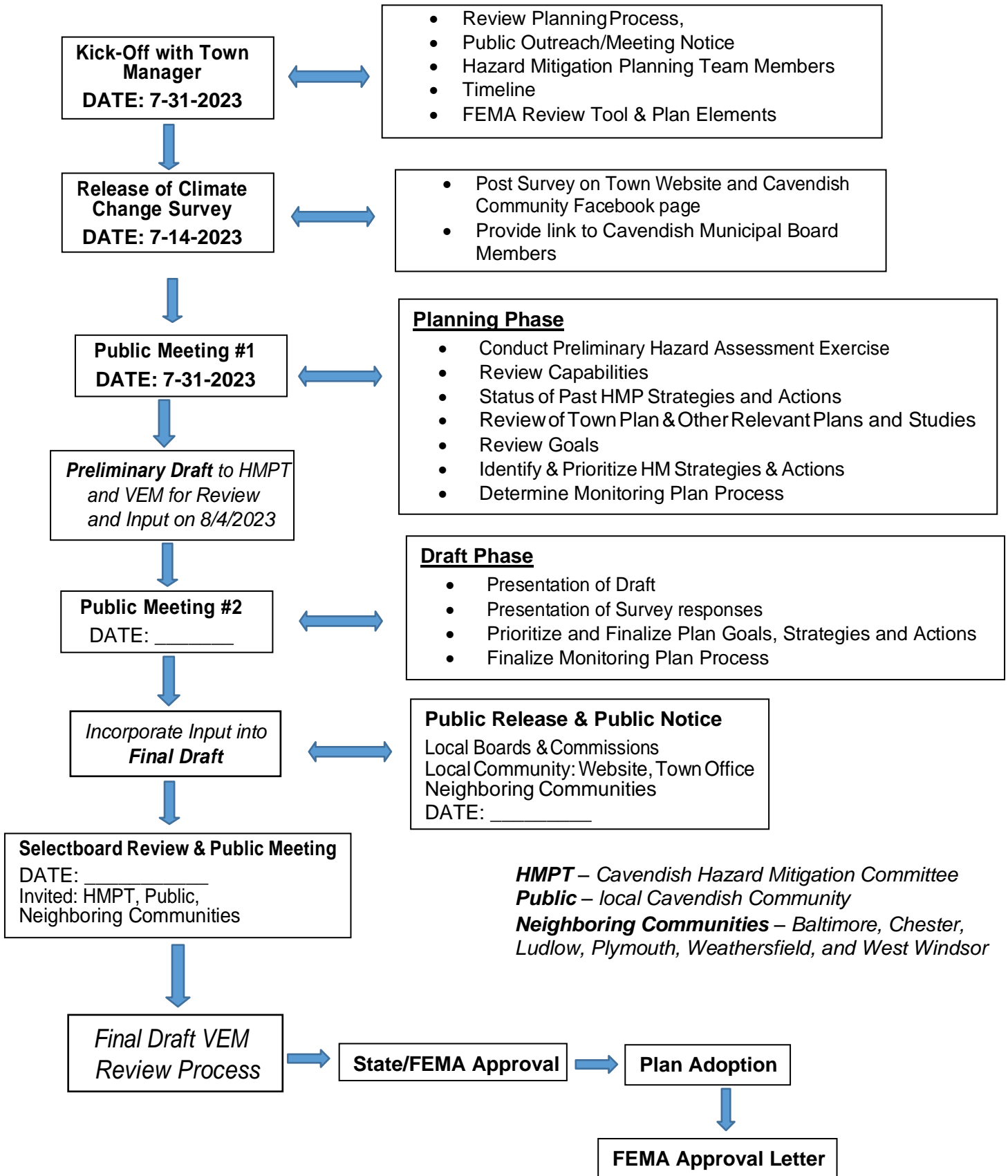
# **Appendix C**

## **Process Flow Chart**

# APPENDIX C

## Town of Cavendish

### 2023-2028 Local Hazard Mitigation Plan



# **Appendix D**

## **Town Plan Review**

## **Cavendish 2020 Town Plan Review**

### **Identified Goals and Recommendations Related to Hazard Mitigation**

**Chapter 10: Flood Resilience:** The purpose of this Chapter is to identify areas that are prone to flooding and erosion hazards, designate areas to be protected, and create policies and strategies that promote community flood resiliency.

1. **Special Flood Hazard Areas:** These are comprised of floodway and floodplain areas, based on FEMA flood insurance rate mapping (D-FIRM) information. Floodplains represent inundation flooding hazards. These floodplains lie mainly along the Black River and Twenty-Mile Stream. There is a total of 65 existing structures located within these flood hazard areas, most of which are within the villages of Proctorsville and Cavendish, and in the Whitesville area.
2. **River Corridors:** River corridors, as mapped by the Agency of Natural Resources, represent portions of town that are particularly at risk of river-related erosion hazards. The mapped river corridors are along the Black River, Twenty Mile Stream, North Branch of the Black River, and some of the larger tributaries.
3. **Lands Adjacent to Smaller Streams:** Other areas may also be at risk from flooding and/or erosion hazards, including land areas along the shoreline of the other streams and surface water bodies in town. The map depicts streams in Cavendish, but – at this time – good data on perennial streams is not available.

The Town Plan Identified the following areas for their role in promoting flood resilience in Cavendish:

1. **Special Flood Hazard Areas:** Generally, new development is discouraged within these flood hazard zones. Any development in these flood hazard areas require local permits and must meet the applicable standards to mitigate against inundation flooding.
2. **River Corridors:** A significant portion of the damages sustained during Tropical Storm Irene were related to river erosion hazards. The Town amended the Flood Hazard Area Regulations that regulates development within river corridors as mapped by the Vermont Agency of Natural Resources.
3. **Stream Setbacks:** Since the mapped special flood hazard areas and river corridors do not include all areas that may be at risk from flooding and erosion hazards, development along the other perennial streams in Town is also at risk. It is recommended that new development be avoided within a minimum area of 50 feet from the stream, measured from the top of the stream bank or slope. (The Planning Commission is also considering including provisions to regulate development along these smaller perennial streams, as recommended in the State flood regulations.)
4. **Wetlands:** Along with their other benefits, wetlands serve an important function to help mitigate flood damages. Wetlands are generally regulated by the State Wetland Rules and Act 250. The Town should coordinate with the Black River Action Team, ANR's Watershed Coordinator, MARC and others to seek grants to protect or improve wetlands for the purpose of flood water retention.
5. **Upland Areas:** Natural vegetation in upland areas and areas of steep slopes contributes to flood resiliency by maximizing on-site infiltration of storm water, which reduces the impacts upon downhill properties. The Town encourages residents in these types of areas to consider taking steps, such as limiting tree cutting, minimizing site disturbances, and using special design techniques to manage stormwater on site.

#### **Flood Resilience Policies and Strategies:**

1. Development plans for lands subject to periodic flooding must comply with local, state and federal flood hazard regulations in order to protect the health, safety and welfare of the public.

2. Any development within the river corridor areas must meet the following standards. For the purposes of this standard, "development" includes any human-made change to structures or land, including but not limited to new structures, improvements of or additions to existing structures, mining, dredging, filling, grading, paving excavating, drilling, or the storage of equipment or materials.

- a) Improvement of existing structures, and any associated fill as needed to comply with elevation requirements in the Special Flood Hazard Area shall not decrease the distance between the existing primary building and the top of bank;
- b) Locate accessory structures within 50 feet of the existing primary building provided that the location does not decrease the distance between the existing primary structure and the top of bank;
- c) Development shall not increase the susceptibility of that or other properties to fluvial erosion damage;
- d) Development shall not increase the potential of materials being swept onto other lands or into the stream and causing damage to other properties from fluvial erosion;
- e) Development shall not cause an undue burden on public services and facilities including roads, bridges, culverts, and emergency service providers during and after fluvial erosion events;
- f) Bridge and culvert projects must have a Stream Alteration Permit; and Cavendish Town Plan Town Vote March 2020;
- g) Channel management activities must be authorized by the Agency of Natural Resources.

3. Holding meetings or providing materials to inform property owners about these flood hazard risks and steps they can take to mitigate their risks (e.g. flood insurance, retrofit projects, property buy-outs, avoid new encroachments in harms-way).

4. Seek grant applications for flood mitigation projects, in coordination with partners, as identified in the Phase 2 stream geomorphic assessment or Basin 10 Plan.

5. Encourage property owners in upland areas to utilize techniques that help to maximize on-site storm water infiltration and minimize off-site storm water flows (e.g. best management practices, green infrastructure or low impact development techniques).

#### **Flood Resilience Recommendations:**

1. Provide information to property owners within the identified flood and erosion hazard zones on what these risks involve and how to lessen future damages.

2. Implement strategies in the All-Hazard Mitigation Plan, including:

- a) Replace undersized culverts.
- b) Purchase land along Winery Road for flood storage.
- c) Encourage property owners to tie down all non-anchored structures.
- d) Identify repeat flood damage properties and develop a system to prevent and/or eliminate the potential for future damage.
- e) Maintain current NFIP status.

#### **From Natural Resources Section**

- The Black River is valued as both a scenic and recreational resource; in order to protect that resource, development is prohibited along the Black River corridor when such values will be negatively impacted.
- Naturally vegetated buffer strips of at least 50-100 feet shall be left next to all rivers, lakes, and ponds, and at least 50 feet next to streams and wetlands, so as to filter pollution, prevent erosion, and protect fisheries and wildlife habitat.

## **Appendix E**

### **Vermont Historic Floods**



## Vermont Historical Flood Events

Event	Date	Description	Impact or Extent of Damage
Great Flood of 1927	November 3, 1927	After a wet October, rivers were swollen and the ground was saturated. Nine inches of rain fell in a 36-hour period triggering disastrous flooding. The month of October saw 150% greater rainfall than normal and lack of vegetation due to de-forestation may have reduced the ground's ability to absorb water. Though all of New England was affected, Vermont was devastated. The state flooded from Newport to Bennington, with the Winooski River Valley the hardest hit. Deadliest disaster in Vermont history.	<ul style="list-style-type: none"> <li>➤ 84 people perished</li> <li>➤ 9,000 left homeless</li> <li>➤ Many roads, countless homes and over 1,200 bridges washed away</li> <li>➤ Over \$28 MM in damages (\$404 million in current \$s)</li> </ul>
The Great New England Hurricane of 1938	September 21, 1938	One of the most powerful and destructive hurricanes to hit southern New England and the region of Southeast Vermont with winds over 100 mph. Authorities were unaware of the magnitude so no evacuation procedures were instituted and very few precautions were taken. The only tropical cyclone to make a direct hit on Vermont in recorded history. Hurricane-force winds caused extensive damage to trees, buildings, and power lines.	<ul style="list-style-type: none"> <li>➤ 600 people perished in southern New England, only 5 in Vermont</li> <li>➤ Over 2,000 miles of roads were blocked taking months to reopen</li> <li>➤ Vermont maple and sugar groves were damaged</li> <li>➤ Over \$300 MM in damages (\$5 Billion in current \$'s)</li> </ul>
Tropical Storm Irene	September 1, 2011	Tropical Storm Irene tracked north northeast across eastern New York and western New England producing widespread flooding, and damaging winds across the region. The greatest impact across central and southern Vermont was due to catastrophic flash flooding as a result of 4 to 7+ inches of rainfall which occurred across all of Windham and Windsor County, especially in the foothills of the Green Mountains. Several dozen roads (state and local), including Routes 4, 12, 12A, 100, 103, 107 and 131, as well as several bridges were washed out or suffered severe damage. Several communities within Windsor County were isolated due to loss infrastructure. Dozens of homes and businesses experienced severe flooding as well as major losses to farms and livestock.	<ul style="list-style-type: none"> <li>➤ Frequent wind gusts of 55-60 mph, peak gusts at 85 mph.</li> <li>➤ 18,000 customers in Windham County lost power.</li> <li>➤ Greatest single-day rainfall in Vermont's recorded history.</li> <li>➤ Rainfall averaged 4 to 8 inches, and up to 11 inches in some areas over a 12-hour period.</li> <li>➤ There were nearly 2400 roads, 800 homes/businesses, 300 bridges and a half dozen railroad tracks destroyed or damaged from the flooding caused by Irene.</li> <li>➤ \$18.7M estimated in Public and Individual FEMA Assistance.</li> </ul>

# **Appendix F**

## **July 2023 Flood Damage**

## Town of Cavendish

### Flood Damage of July 2023

As reported by the community 7-31-2023

#### Businesses Impacted

- Smokin Bowls (Route 103) Not opened
- Black River (Route 103) Not opened
- Murdocks (P Green) Opened
- Outer Limits (P Green) Not opened
- Former Crows Bakery (Depot St) Not opened
- DG Body Works, Post Office (part of Pollard Black Stewart Property Management on Depot St):  
Opened but sustained damage
- Red Vault Productions (Depot) heavy damage not opened. Home and studio combination
- Singletons (131) damaged but open, closed one day
- Happy Hound (Greven Rd X): Closed-dog grooming business
- Day Care at Farrar's on 131 in flood plain. Closed
- Mack Molding on 131, closed one day
- Proctorsville Fire Dept flooded basement but open
- Paw's Lodge (off Winery Rd) recently re opened
- Gethsemane Church: primarily property damage (Depot)
- Former Crow's Bakery
- Outer Limits

Greven Recreational Field

#### Residential Structures on the following roads were impacted

Carlton Rd: major damage to second homes

Cavendish Gulf Rd: primarily property damage

Chapman Rd, Davis Rd., Greven Rd., Greven Rd. Ext., High Street, Mill St., Mountain View, The Lane, Twentymile Stream Rd.: 2 to 3 homes impacted on each

Almost the entirety of Depot St., approximately 20 properties, including multi family structures.

Approximately 12 homes along Main St.

#### Roads impacted:

Essentially all roads were impacted to some degree.  
Those that sustained the significant damage include:

Route 103

Route 131/Main St.

Depot St.

The Lane  
Whitesville Rd.  
Whites Hill Rd.  
Hardsgravel Rd.  
Davis Rd.  
Heald Rd.  
Upper and lower Twenty-mile Stream Rd.  
Brook Rd.  
Winery Rod.  
Gulf Rd.  
Country Rd.  
Tarbell Rd.  
Stevens Rd.  
Mill Rd.  
Carlton Rd,  
Greven Rd.  
Power Plant Rd.

**Appendix G**  
**Plan Monitoring Forms**